

ATTACHMENT 1

CHEVRON PRODUCTS COMPANY
Salt Lake Refinery
Revised Water Data Collection Quality Assurance Plan
For The Salt Lake Refinery

EarthFax Engineering, Inc.

POST CLOSURE PERMIT – ATTACHMENT 1

**REVISED WATER DATA COLLECTION
QUALITY ASSURANCE PLAN
FOR THE SALT LAKE REFINERY**

**CHEVRON PRODUCTS COMPANY
Salt Lake Refinery
Salt Lake City, Utah**

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
CHAPTER 1 - INTRODUCTION	1-1
CHAPTER 2 - GENERAL PROCEDURES.....	2-1
2.1 INTRODUCTION	2-1
2.2 DECONTAMINATION PROCEDURES	2-1
2.2.1 Sensitive Equipment	2-2
2.2.2 Non-Sensitive Equipment	2-2
2.3 MEASUREMENT OF FIELD WATER-QUALITY PARAMETERS	2-4
2.3.1 pH and Temperature.....	2-5
2.3.2 Specific Conductance.....	2-7
2.4 DOCUMENTATION OF FIELD CHAIN OF CUSTODY	2-8
2.4.1 Analysis Request Forms.....	2-9
2.4.2 Sample Labels	2-9
2.4.3 Chain-of-Custody Forms.....	2-10
2.4.4 Custody Seals	2-11
2.4.5 Field Log Forms	2-11
2.5 SAMPLE HANDLING PROCEDURES	2-12
2.5.1 Sample Containers	2-12
2.5.2 Sample Filtration.....	2-13
2.5.3 Sample Preservation.....	2-15
2.5.4 Sample Packing	2-16
2.5.5 Sample Shipping	2-17
2.6 FIELD QUALITY CONTROL.....	2-18
2.6.1 Equipment Blanks.....	2-18
2.6.1.1 Groundwater Equipment Blanks	2-18
2.6.1.2 Surface-Water Equipment Blanks	2-20

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Page</u>
2.6.2 Field Blanks	2-21
2.6.3 Trip Blanks	2-21
2.6.4 Blind Duplicates	2-22
2.6.4.1 Groundwater Blind Duplicates	2-22
2.6.4.2 Surface-Water Blind Duplicates	2-23
2.6.5 New Equipment Issues	2-24
2.7 ACQUISITION OF SAMPLING SUPPLIES	2-25
2.8 RECORDS MANAGEMENT	2-26
CHAPTER 3 - COLLECTION OF GROUNDWATER ELEVATION AND FREE-PHASE HYDROCARBON THICKNESS DATA	3-1
3.1 INTRODUCTION	3-1
3.2 GENERAL PROCEDURES	3-2
3.3 MEASUREMENTS USING AN INTERFACE PROBE	3-3
3.4 MEASUREMENTS USING A WATER-LEVEL INDICATOR	3-4
3.5 MEASUREMENTS AT FLOWING WELLS	3-5
3.6 WELL DEPTH MEASUREMENTS	3-5
CHAPTER 4 - GROUNDWATER QUALITY SAMPLING	4-1
4.1 INTRODUCTION	4-1
4.2 SAMPLING ORDER OF MONITOR WELLS	4-2
4.3 WELL PURGING AND SAMPLE COLLECTION	4-2
4.3.1 Health and Safety Considerations	4-2
4.3.2 Pre-Sampling Operations	4-3

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Page</u>
4.3.3 Sampling Free-Phase Hydrocarbons.....	4-4
4.3.4 Well Purging	4-5
4.3.4.1 Purge Operations	4-5
4.3.4.2 Micro-Purge	4-8
4.3.4.3 Purge Water Disposal	4-9
4.3.5 Sample Collection	4-9
CHAPTER 5 - SURFACE-WATER QUALITY SAMPLING	5-1
5.1 INTRODUCTION	5-1
5.2 SAMPLING SITE SELECTION.....	5-1
5.3 HEALTH AND SAFETY CONSIDERATIONS	5-2
5.4 GRAB SAMPLE COLLECTION	5-2
5.4.1 Sampling Equipment.....	5-2
5.4.2 Measurement of Field Parameters	5-3
5.4.3 Sample Collection	5-3
5.5 POND SAMPLE COLLECTION.....	5-5
5.5.1 Sampling Equipment.....	5-5
5.5.2 Measurement of Field Parameters	5-6
5.5.3 Sample Collection	5-7
CHAPTER 6 - REFERENCES.....	6-1

TABLES

Table

- 1-1 Groundwater Analyte List for the RWMA, LWMA and GWMA**
- 2-1 Sample Preservation Requirements**
- 3-1 GWMA Monitor Well Completion Summary**
- 3-2 RWMA and LWMA Monitor Well Completion Summary**

FIGURES

Figure

- 1-1 Location of GWMA Compliance Wells**
- 1-2 Location of RWMA Compliance Wells**
- 1-3 Location of LWMA Compliance Wells**
- 1-4 Location of all Permit Compliance Monitor Wells**
- 1-5 Location of all Facility Shallow Monitor Wells**
- 2-1 Analysis Request Form**
- 2-2 Sample Label**
- 2-3 Chain-of-Custody Form**
- 2-4 Custody Seal**
- 2-5 Surface-Water Field Log**

FIGURES (CONTINUED)

Figure

2-6 Groundwater Field Log

2-7 Sample Splitter

3-1 Cap for Measuring Water Levels in Flowing Wells

4-1 Flow Chart of Groundwater Sampling Procedures

5-1 Flow Chart of Surface-Water Sampling Procedures

**REVISED WATER DATA COLLECTION
QUALITY ASSURANCE PLAN
FOR THE SALT LAKE REFINERY**

CHAPTER 1

INTRODUCTION

On September 2, 1997 the Utah Solid and Hazardous Waste Control Board issued a Post Closure Permit ("Permit") to Chevron Products Company ("Chevron") for their Salt Lake Refinery. The primary purpose of this Permit was to stipulate certain requirements for the monitoring and maintenance of regulated units at Chevron's Salt Lake Refinery.

This Revised Water Data Collection Quality Assurance Plan is submitted pursuant to the requirements of the Permit. The plan presents methods for the collection, preservation, and handling of surface and groundwater samples and data at the Salt Lake Refinery. This revised plan is based on the original plan prepared by EarthFax in 1991 as Appendix D of Chevrone's RCRA Facility Investigation Work Plan. The data collection plan was again revised in 1997 and submitted as Attachment 1 in the Permit.

This new version presents changes and revisions to facility drawings, well designations and locations as well as other miscellaneous changes at the facility. Finally, new methods of water quality monitoring are incorporated into this revised plan, such as the use of a flow cell to monitor purge water and for the use of micro-purging in wells that have proven to have limited yield since monitoring began in 1984.

Procedures described in this document were prepared using guidelines published by the U.S. Environmental Protection Agency (1986a, 1986b). Guidelines of the U.S.

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Geological Survey (1977) were also reviewed in preparing surface-water monitoring protocols.

A facility map depicting the post closure compliance monitor wells for the facility wide Groundwater Waste Management Area (GWMA) is provided on Figure 1-1. Figures 1-2 and 1-3 show the location of compliance monitor wells for the Reservoir Waste Management Area and the Landfill Waste Management Area, respectively. Figure 1-4 shows all of these wells relative to each other across the facility. Figure 1-5 shows all shallow wells at the facility from which water level data are collected. The parameters for which samples are to be analyzed are presented on Tables 1-1.

This plan is divided into six chapters, including this introduction. Chapter 2 presents a discussion of general procedures to be followed in the collection of both surface and groundwater samples. Methods for the collection of fluid-level data are presented in Chapter 3. Chapters 4 and 5 present details concerning the collection of groundwater and surface-water samples, respectively. References cited in this plan are listed in Chapter 6.

CHAPTER 2

GENERAL PROCEDURES

2.1 INTRODUCTION

This chapter presents procedures which are common to the collection of both surface-water and groundwater samples. These procedures include:

- o Decontamination,
- o Field water-quality measurements,
- o Sample handling, labeling, and documentation,
- o Field quality control, and
- o Records management.

These topics are discussed here to avoid excessive repetition in subsequent chapters.

2.2 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment is both a necessary and a critical aspect of sampling. Decontamination reduces the potential for cross-contamination between samples and sample locations. All equipment and instruments utilized in the sampling process must be properly decontaminated prior to collection of each sample and following collection of the final sample of a sampling campaign.

Proper decontamination can not be overemphasized. Careful decontamination helps to assure that samples collected are neither diluted nor accidentally contaminated. Improper decontamination can result in costly re-collection and re-analysis of samples.

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2.2.1 Sensitive Equipment

The term "sensitive equipment" herein refers to scientific instruments (e.g., pH meters, specific conductance meters, etc.) that may be damaged by a rigorous decontamination procedure. Sensitive equipment shall normally be decontaminated using only a distilled-water rinse. Following rinsing, the instrument shall be gently wiped using a disposable paper towel. In no case shall high-pressure steam or abrasive cleaners be used to decontaminate sensitive equipment.

If persistent surface residues exist following rinsing, a non-abrasive non-phosphate laboratory detergent (such as Liqui-nox or equivalent) and a soft cloth or a soft-bristled plastic scrub brush may be used on sensitive equipment. This washing procedure shall be followed by a tap-water rinse and a distilled-water rinse. If persistent residues remain following the detergent cleaning and these residues affect the accuracy of the instrument, that portion of the instrument affected by the residues shall be discarded and a new part shall be installed.

Extreme caution shall be used when cleaning scientific instruments to avoid abrasion, bending, or cracking of the instrument probes or cables. Any physical damage to the instruments can result in incorrect readings. If the damaged instruments and erroneous readings are not detected until the sampling round has been completed, costly re-sampling and re-analysis will be required. Damaged parts shall be either immediately repaired or replaced.

2.2.2 Non-Sensitive Equipment

The term "non-sensitive equipment" refers to rugged equipment used in the sampling process (e.g., pumps, bailers, ladles, etc). Prior to the use of non-sensitive

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sampling equipment, each piece of equipment and its carrying case (if applicable) shall be steam-cleaned. Heavy waterproof gloves shall be worn during steam cleaning to reduce the potential for cross-contamination between samples and to protect against skin contact with steam and potential contaminants. These gloves shall be steam-cleaned or replaced between each sample location.

All steam cleaning operations at the Salt Lake Refinery shall be conducted at a steam-cleaning pad approved by Chevron. Steam nozzles shall be free of any visible oily material before use. A permit must be obtained daily from Chevron maintenance before the steam-cleaning pad can be used.

Where feasible, equipment to be steam cleaned shall be disassembled prior to decontamination to permit adequate cleaning of the internal portions of the equipment. The equipment shall be placed on metal cleaning racks which support the equipment above the ground surface for cleaning and rinsing.

Following steam cleaning of the equipment and the respective carrying cases, the equipment and cases shall be thoroughly rinsed with distilled water. The equipment shall then be re-assembled if necessary and placed in the decontaminated carrying cases or protected by placing the items within a clean plastic bag.

If persistent surface residues exist or if equipment blanks indicate the presence of residual contamination, additional decontamination of the non-sensitive equipment shall occur. This additional decontamination shall be as follows:

- o Initial steam cleaning
- o Wash (using a brush or cloth) with a non-phosphate laboratory detergent
- o Rinse with tap water

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- o Rinse with distilled water
- o Rinse (and scrub using a brush or cloth, if necessary) with acetone
- o Rinse (and scrub using a brush or cloth, if necessary) with pesticide-quality hexane
- o Air dry
- o Rinse with tap water
- o Final rinse with distilled water

When utilizing the above decontamination procedure, care shall be taken to contain the used solvents. Thus, decontamination by the above procedure shall occur over a bowl, bucket, or other container to catch the solvent rinsate. Waste solvents from the decontamination procedure may require special handling as a hazardous material.

2.3 MEASUREMENT OF FIELD WATER-QUALITY PARAMETERS

Field water-quality parameters (pH, temperature, and specific conductance) shall be measured at each monitor well and surface-water sampling station at the time of sample collection. Instruments used to measure these parameters shall be removed from their protective cases during use to prevent the accumulation of moisture within the cases. Disposable bags of desiccant shall be kept in the protective instrument cases at all times to prevent moisture accumulation. During periods of precipitation, the instruments shall be protected or operated in enclosed areas (e.g., within the cab of the sampling vehicle).

2.3.1 pH and Temperature

A portable meter shall be used to collect pH and temperature data. This meter shall be capable of accurately determining the pH of a solution to the nearest 0.01 unit and the temperature to the nearest 0.1 °C.

The pH meter shall be calibrated prior to measurements at each monitor well or surface-water sampling station. Calibration shall be performed according to manufacturer's specifications using pH 4 and pH 10 buffer solutions. Information concerning the buffer solutions that is to be recorded in the field log book during calibration shall include:

- o Manufacturer**
- o Production lot number**
- o pH**
- o Expiration date**

To calibrate the pH meter, the pH and temperature probes and a small, clean, plastic container shall be thoroughly rinsed with one of the calibration solutions. The plastic container shall then be filled with the calibration solution, the probes shall be placed in the solution, and the meter shall be calibrated according to the directions of the meter manufacturer. Because the calibration solution (pH 4 or pH 10) does not fall outside of the pH range to be characteristically corrosive (that range being ≤ 2 or ≥ 12), the used solution in the container shall be discarded to the ground surface following calibration.

Following calibration to the first solution, the probes and container shall be thoroughly rinsed with the second calibration solution. The plastic container shall then be filled with the second solution, the probes shall be placed in the solution, and the meter

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shall be calibrated in accordance with the manufacturer's directions. Following calibration, remaining solution shall be discarded to the ground surface.

If the measured pH of the calibration buffer solutions varies by more than plus or minus 0.05 pH units from the temperature-corrected values printed on the buffer solution bottles, the source of the error shall be checked. If either of the calibration solutions have expired, the solution shall be discarded and replaced with new solution. If the calibration solutions are valid, the pH probe shall be discarded and a new probe shall be attached. Following correction of the problem, the meter shall be re-calibrated.

The accuracy of the pH meter shall be checked after every fifth measurement during the purge operation at monitor wells. Accuracy checks are not necessary at surface water sampling stations because the pH meter will be calibrated immediately prior to each measurement.

To check the accuracy of the pH meter, a pH 7 buffer solution shall be used. If the measured pH of the check buffer solution varies by more than plus or minus 0.05 pH units from the temperature-corrected value printed on the buffer solution bottle, the pH meter shall be recalibrated using the pH 4 and pH 10 buffer solutions.

Field measurements of pH and temperature shall be conducted in accordance with the manufacturer's instructions using water collected in a decontaminated, stainless-steel cup or a flow cell. Bottles intended for sample collection and storage shall not be used for this purpose.

The cup shall be rinsed with the sample water prior to filling. The pH and temperature probes shall be rinsed in a portion of the water from the cup. Following rinsing, the probes shall be placed vertically in the sample cup. Water in the sample cup

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shall be of sufficient depth to immerse the sensing elements at the tips of the probes. This water depth shall not extend above the open port in the pH probe. After immersing the instrument probes, the pH and temperature values of the sample shall be determined. pH data shall be measured to the nearest 0.01 unit and temperature to the nearest 0.1 °C. Values of pH and temperature shall be recorded on the appropriate sampling form (see Section 2.4.5). Instrument probes shall be decontaminated immediately after use at each location to prevent contamination of the storage case.

2.3.2 Specific Conductance

Specific conductance measurements shall be made using a portable temperature-compensating specific conductance meter. The meter shall be capable of measuring the conductance with an error of not more than one percent.

Sample water used for conductance measurements shall be collected in a decontaminated stainless steel container. The temperature and conductance probes shall be rinsed thoroughly with water from the sample container and then inserted vertically into the container. The water level within the container shall be sufficient to cover the uppermost water-circulation hole in the conductance probe. The conductance probe shall be gently agitated after immersion in the water sample to release air trapped within the probe chamber. Failure to remove the air within the probe will result in incorrect instrument readings.

After inserting the probes into the sample water and displacing all air trapped within the probe chambers, the conductance shall be read according to manufacturers instructions. This value shall be recorded on the appropriate sampling form (see Section 2.4.5). After taking the readings, instrument probes shall be rinsed with distilled water

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and gently wiped with a disposable paper towel before they are returned to the instrument case to prevent contamination of the storage case.

The accuracy of the specific conductance meter shall be checked after every 10 samples using a standard 0.0100 molar potassium chloride solution. This solution has a specific conductance of 1,413 mmhos/cm at 25 °C. If the conductance reading during this check measurement varies by more than five percent of the actual value (i.e., falls outside of the range of 1,342 to 1,484 mmhos/cm at 25 °C), the accuracy of the check solution shall be determined. If the check solution is valid, the probe and/or meter shall be serviced or replaced in accordance with the manufacturer's instructions to remedy the problem.

2.4 DOCUMENTATION OF FIELD CHAIN OF CUSTODY

Documentation of field sample control is necessary to allow tracing of individual samples from the time of collection through delivery to the laboratory. This documentation further assists in determining whether or not data are representative of in-situ conditions. Detailed records must be maintained to provide quality assurance and quality control in the sampling program. A companion (extended) chain-of-custody program is implemented by the analytical laboratory.

A sample is considered to be in a person's custody if it is:

- o In a person's physical possession,
- o In view of the person after the sample has been collected,
- o Secured by that person so that no one can tamper with the sample,
or
- o Secured by that person in an area which is restricted to authorized personnel.

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The components of chain of custody include analysis request forms, sample labels, chain-of-custody forms, custody seals, and field log forms. Procedures for the use of these forms are described in the following sections.

2.4.1 Analysis Request Forms

Prior to the collection of any sample, an analysis request form shall be prepared for each sampling station. A typical analysis request form is shown in Figure 2-1. This form shall be in duplicate. The original of the form shall be shipped to the laboratory with the samples and the duplicate copy shall be kept in the project files.

The analysis request form includes information concerning specific bottle types that are supplied by the analytical laboratory. Each bottle type corresponds to a given set of analyses as identified by the laboratory. The number of bottles required for the analyses to be performed during a given sampling campaign shall be based on the analyte list presented in the Permit and as specified by the Chevron project manager.

The analysis request form shall specify the quantity and types of bottles to be used for each sampling site as well as the chemical preservative(s) required (if any) in each bottle. Completion of the form shall be the responsibility of the sample collector. The analysis request forms shall be reviewed by the sample collector immediately prior to sampling and then again prior to shipping to ensure that the appropriate type and number of bottles have been filled and are being shipped.

2.4.2 Sample Labels

Sample labels (Figure 2-2) shall be used to identify the samples. Labels shall be sufficiently durable to remain legible even when wet.

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Labels shall be marked with indelible ink and affixed to sample containers prior to sample collection. Affixing the labels after sample collection may be difficult because the bottles may be wet or cold. In the event labels must be added after collection, the bottle shall be dried and the labels taped onto the bottle using polyethylene tape wrapped around the bottle two times, such that tape is affixed to a previous layer of tape.

After collection of each sample, the date and time of collection shall be recorded on the sample labels. The collector shall then initial or sign the labels.

2.4.3 Chain-of-Custody Forms

To establish the documentation necessary to trace sample possession from the time of collection through laboratory analysis, a chain-of-custody form shall accompany all samples. A typical chain-of-custody form is illustrated in Figure 2-3. This form shall be in duplicate. The original of the form shall be shipped to the laboratory with the samples and the duplicate copy shall be kept in the project files.

One chain-of-custody form shall accompany each shipping container of samples. After the collected samples are recorded in the spaces provided on the chain-of-custody form, the collector shall sign the form and place it in a sealed plastic bag in the shipping container with the samples to await shipment at the end of the day. While the samples are in the custody of the collector, they shall not be left unattended at locations where the samples may be tampered with.

When the samples are relinquished to the laboratory or air courier, the collector shall sign the appropriate relinquishment box on the form. The collector shall then ensure that the receiver acknowledges receiving the samples by also signing the form.

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2.4.4 Custody Seals

Custody seals (Figure 2-4) are used to detect unauthorized tampering with the containers in which the samples are shipped. The seal must be attached to the shipping container (normally an ice chest supplied by the analytical laboratory) in such a way that it is necessary to break the seal to open the shipping container. Custody seals shall be used whether the samples are delivered to the laboratory in person by the sampling personnel or by an air courier service.

The custody seal must be affixed to the shipping container before the samples leave the custody of the sampling personnel. The custody seal shall be secured to the shipping container by affixing strapping tape on both edges of the custody seal to prevent accidental breakage or removal during handling of the shipping containers.

2.4.5 Field Log Forms

All field data shall be recorded in ink on field log forms. Figures 2-5 and 2-6 illustrate log forms for the collection of surface-water data and groundwater data, respectively. The field log forms shall be used each time sampling is performed.

It is the responsibility of the sample collector to ensure that the information recorded on the log forms is accurate. These data are vital to interpretation of the sample results. Thus, it is imperative that the information be entered during sample collection to ensure that the data are accurately recorded.

The log forms shall be bound into field log books. Separate log books shall be dedicated to surface water and groundwater sampling. The covers of the log books shall indicate:

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- o The name and address of the Salt Lake Refinery
- o The name and address of the Chevron project manager
- o The purpose of the sampling (surface water or groundwater)
- o The conclusive dates during which the books were in use

These log books shall be kept in the custody of the sample collector during sampling and in the custody of the project manager during non-sampling periods.

2.5 SAMPLE HANDLING PROCEDURES

2.5.1 Sample Containers

Sample containers will be stored in a safe location, out of direct contact with the sun or any other source of heat which may raise the temperature of the sample as it enters the container. Sample containers shall at no time be placed on the ground. Containers awaiting use during actual collection of the sample will be placed on a table, tailgate or other hard surface free of any objects which may damage the container. Upon collection of the sample, each container will be capped and placed directly into the same shipping carton or cooler from which it was originally taken.

In a effort to avoid potential for contamination of samples, adhesive materials shall be used only on the labels to be placed on the container (see section 2.4.2). The use of any type of adhesive tape other than polyethylene or Teflon is not allowed. Temporary anchoring or attachment of sampling tubes, pump leads, pump return lines, etc. shall be by mechanical means such as new, clean plastic bag ties or nylon cable ties. These devices shall be disposed of after their use.

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2.5.2 Sample Filtration

Samples that are designated for analysis of dissolved metals (as noted on the analysis request form) will require filtration at the time of collection. Filtering equipment may include a battery-powered peristaltic pump, a filter holder, and disposable filter media. The filter holder can be either reusable (capable of holding a 142-mm diameter filter) or disposable.

If disposable filter holders are used, the unit shall have a high-capacity rating with a filter surface area of approximately 600 cm². The filter shall be a nylon membrane type capable of retaining particles larger than 0.45 microns. The filter holder shall be constructed of polypropylene or similar material.

For filtration of pumped groundwater samples using a disposable filter holder, the filter holder shall be attached directly to the discharge tubing of the sample pump. Prior to collection of the sample, approximately one quart of the well water shall be pumped through the filter unit and discarded to the same location as the purge water. The sample-collection bottle for the filtered sample shall then be filled with water being discharged from the filter holder. The bottle shall be filled to capacity, taking care to avoid overflow that would spill the preservatives.

For filtration of bailed groundwater samples and surface-water samples using a disposable filter holder, at least one-half gallon of the water to be filtered shall be collected in a decontaminated stainless steel container. Prior to filtration, the tubing on the peristaltic pump shall be rinsed by pumping at least one-half gallon of distilled water through the unit. If persistent residues exist on the interior of the pump tubing, the tubing shall be replaced.

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The intake end of the peristaltic pump tubing shall be rinsed with a portion of the sample and the tubing shall be placed into the water in the container. The discharge end of the tubing shall be fitted to the disposable filter holder. Approximately one quart of the sample shall then be pumped through the filter assembly and discharged to the same location as the purge water for groundwater samples and to the source for surface-water samples. The sample-collection bottle for the filtered sample shall then be filled with water being discharged from the filter holder, taking care to avoid overflow.

If samples are to be filtered using a reusable filter holder, the filter holder shall be decontaminated prior to use by steam cleaning. The filter holder and peristaltic pump tubing shall then be thoroughly rinsed by pumping one-half gallon of distilled water through the tubing and filter holder. If persistent residues exist on the filter holder, the residues shall be cleaned from the apparatus using a soft-bristled brush and a 20-percent solution of hydrochloric acid. This decontamination shall occur over a catch basin to avoid spillage of the acid. The waste acid may require special handling. Gloves shall be worn when handling the acid. If persistent residues exist on the interior of the pump tubing, the tubing shall be replaced.

After decontaminating, the reusable filter holder shall be fitted with two filters. The bottom-most filter shall be a nylon membrane filter with a diameter of 142 mm and a pore size of 0.45 micron. The upper filter shall be manufactured of sterile glass fiber with a diameter of 142 mm. Use of a glass-fiber pre-filter minimizes the potential for premature clogging of the membrane filter during filtration.

Care must be taken during installation of the filters to ensure that no foreign materials outside of the water contact the filter media or that the filter media become crimped or damaged. If foreign materials are introduced or the filter media are damaged, the filters shall be replaced prior to use.

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Following assembly of the filter device and immediately prior to filtering, at least one-half gallon of the water to be filtered shall be collected in a decontaminated stainless steel container. The intake end of the pump tubing shall then be rinsed with a portion of the sample and the tubing shall be placed directly into the sample. The discharge end of the tubing shall be fitted to the filter holder. *Approximately one quart of the sample shall be pumped through the filter assembly and discharged to the same location as the purge water for groundwater samples and to the source for surface-water samples.* The sample-collection bottle for the filtered sample shall then be filled with water being discharged from the filter holder. The bottle shall be filled to capacity, taking care to avoid overflow.

After filling, the intake end of the peristaltic pump tubing shall be removed from the half-gallon container and the pump shall remain running until the tubing and filter assembly have been purged of sample water. The used filters shall then be removed and the filter holder shall be thoroughly rinsed with distilled water.

2.5.3 Sample Preservation

The analysis request form (Figure 2-1) shall indicate the types of preservatives required for each sample bottle. Cooling to 4 °C is achieved by placing the sample bottles in an ice chest and covering the bottles with crushed ice. Ice shall be placed around the sample bottles immediately following collection. All samples collected shall be cooled in this manner regardless of their chemical preservation unless advised otherwise.

Chemical preservatives include several acids and bases (see Table 2-1). These preservatives will be added to the bottles by the laboratory prior to receipt. Most of the chemical preservatives are corrosive and must be treated with caution. Sampling personnel shall avoid skin or eye contact with the preservatives and wear safety glasses and disposable waterproof gloves for protection at all times during handling. During

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sampling, large quantities of clean water shall be available for irrigation should skin or eye contact occur.

2.5.4 Sample Packing

Samples shall be placed in ice chest shipping containers with crushed ice. The samples shall be placed vertically, with the capped end up, in a single layer. Bottles shall not be packed on top of one another. The laboratory should provide a small temperature blank for use in confirming that the samples are at the proper temperature when they arrive at the laboratory.

Glass bottles shall be placed in protective foam or bubble-pack sleeves. All bottles shall be checked for cap tightness to prevent sample leakage during transport. Care shall be taken to prevent over tightening and breakage of bottle caps.

Sufficient ice and packing material shall be placed in each ice chest to minimize the potential for bottle movement and damage during shipment. In addition, care shall be taken to insure that plastic caps on bottles are adequately covered by foam packing to prevent breakage.

In the event a bottle breaks, it shall be removed immediately from the shipping container. If the contents of the bottle spilled inside the container, all bottles, ice, and packing material shall be removed and the container shall be cleaned. The sample with the broken bottle shall be entirely re-collected, including those bottles associated with the sample that were not broken. The ice and packing material shall be replaced. All bottles shall be wiped dry before being placed back into the clean container.

Sampling personnel shall inventory the sample bottles from each sampling site prior to shipment to insure that all samples listed on the analysis request form and the chain-of-

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custody form are present. All bottles collected from a specific sampling station shall be packed and shipped together in the same container. Bottles from separate sampling sites packed together in the same container shall be separated from one another with sheets of foam packing material.

2.5.5 Sample Shipping

Each shipping container shall contain an analysis request form and a chain-of-custody form for the sample(s) within the container. If samples are shipped via air-courier service, the number from the air-courier bill that accompanies the shipping containers shall be entered on the chain-of-custody form. The sampler shall complete the chain-of-custody form at the time the samples are relinquished (either to the laboratory for local analytical work or to the air-courier service for out-of-state analytical work). Sampling personnel shall sign their name and the time relinquished in the proper location on the form. The receiving party shall also sign his or her name on the form upon receipt.

The originals of the analysis request and chain-of-custody forms shall be sealed in a waterproof plastic bag and placed inside the ice chest prior to sealing of the container. The ice chest shall be securely closed and latched, and a custody seal shall be placed across the transition between the container body and lid. After applying the custody label, strapping tape shall be applied to secure the lid to the body to prevent it from opening during shipment. Tape shall also be used to secure the custody seal to the shipping container.

Sampling personnel shall prepare air-courier bill identification labels in strict accordance with the U.S. Department of Transportation procedures if any of the samples being shipped are suspected to contain listed hazardous materials. Labeling procedures

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have been detailed by the Association of American Railroads (1989 et seq.) and the International Air Transport Association (1991 et seq.).

2.6 FIELD QUALITY CONTROL

Quality control is essential to ensure the reliability and validity of field data. Field quality control procedures shall include the collection of equipment blanks, field blanks, trip blanks, and blind duplicates. These samples are collected as an aid in determining sample biases introduced by equipment decontamination procedures, sample handling, laboratory procedures, transportation procedures, and random errors.

2.6.1 Equipment Blanks

Equipment blanks aid in quantifying sample bias due to collection procedures. Dedicated sampling systems have been installed in all Permit monitor wells to be sampled under this protocol. Consequently, equipment blanks will not be required for the dedicated groundwater sampling equipment. Equipment blanks will, however, be required for portable groundwater sampling equipment and for surface-water sampling equipment.

2.6.1.1 Groundwater Equipment Blanks

The number of equipment blanks to be collected during a groundwater sampling campaign shall equal 10 percent of the total number of monitor wells to be sampled with portable pumps (rounded up to the nearest whole number), with a minimum of one equipment blank collected during each sampling campaign. These blanks shall be collected using the portable sampling pump used immediately following the collection of samples from a randomly-selected well.

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Prior to collection of an equipment blank, the portable sampling pump shall be decontaminated as outlined in Section 2.2. The portable pump shall then be lowered into a decontaminated stainless-steel or Teflon tube with a diameter slightly larger than the pump. This tube shall be capped on the bottom to hold water. Distilled water shall then be continuously poured into and pumped from the tube using the new pump. Pumping for the equipment blank shall continue for a period of 60 minutes (i.e., a time that is generally representative of purge times in the monitor wells). During this time, pH, specific conductance, and temperature measurements shall be taken of the discharging water every 15 minutes. Similar field measurements shall be taken of each separate container of distilled water used for the equipment blank. A field blank of the final container of distilled water shall also be collected.

The distilled water used for equipment blanks shall be obtained commercially and shall have a specific conductance that does not exceed 10 mmhos/cm at 25 °C. These field measurements shall be recorded on the appropriate forms.

Equipment blanks shall be labeled EBG-"n", where "n" is the equipment-blank number (beginning with 1 for the first blank collected during a sample campaign and continuing numerically upward). This equipment-blank number and the designations of the wells which immediately preceded and superseded collection of the blank shall be recorded in the field log book for future reference.

The equipment blank shall be analyzed for the same constituents as the sample collected from the previous monitor well. Equipment blanks shall be preserved, packed, and shipped in an identical manner to standard samples.

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2.6.1.2 Surface-Water Equipment Blanks

The number of equipment blanks to be collected during a surface-water sampling campaign shall equal 10 percent of the surface-water stations to be sampled (rounded up to the nearest whole number), with a minimum of one equipment blank collected during each sampling campaign. These blanks shall be collected immediately following sample collection from a randomly selected stations and shall be representative of the equipment used for collection of the previous sample.

Prior to collection of an equipment blank, the equipment shall be decontaminated as outlined in Section 2.2. Equipment blanks representative of grab-sample conditions shall be collected by filling the decontaminated sample ladle with distilled water. This water shall then be transferred to properly labeled and preserved sample bottles. Equipment blanks representative of pond samples shall be obtained by filling the decontaminated bailer with distilled water and emptying the distilled water into the appropriate sample bottles.

The distilled water used for equipment blanks shall be obtained commercially and shall have a specific conductance that does not exceed 10 mmhos/cm at 25 °C. Specific conductance, pH, and temperature measurements shall be performed on the distilled water both prior to and following collection of the blank. These field measurements shall be recorded on the appropriate forms.

Equipment blanks shall be labeled EBS-"n", where "n" is the equipment-blank number (beginning with 1 for the first blank collected during a sample campaign and continuing numerically upward). This equipment-blank number and the designations of the stations which immediately preceded and superseded collection of the blank shall be recorded in the field log book for future reference.

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The equipment blank shall be analyzed for the same constituents as the sample collected from the previous surface-water station. Equipment blanks shall be preserved, packed, and shipped in an identical manner to standard samples.

2.6.2 Field Blanks

Each time an equipment blank is collected, a field blank shall also be collected. The field blank consists of distilled water collected from the source used for the equipment blank. This water shall be collected directly from the distilled water containers without contacting any of the sampling equipment. The field blank shall be submitted for laboratory analyses to confirm the purity of the commercially-obtained distilled water and thus monitor the possibility of false positive results in the equipment blank.

Field blanks shall be analyzed for the same constituents as the accompanying equipment blanks. Field blanks shall be labeled FB-1 for the first blank, FB-2 for the second blank, etc. Field pH, specific conductance, and temperature shall be recorded for the field blank on the field log along with other information as appropriate.

2.6.3 Trip Blanks

For each surface- and groundwater sampling campaign, the analytical laboratory shall be requested to ship bottles of each type that have been pre-filled by the laboratory with distilled or deionized water. A sufficient number of these bottle sets (referred to as trip blanks) shall be ordered to correspond to 10 percent of the total number of samples to be collected during the sampling campaign.

Ten percent of the surface-water and groundwater sampling stations shall be randomly selected prior to the beginning of a sampling campaign. One set of trip-blank

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bottles shall be taken to each of these randomly-selected stations during the collection of normal samples at those locations. The bottles shall be retained at the location but not opened during sampling of the station. The trip-blank bottles shall be handled identically to the handling procedures for bottles used for actual sample collection.

The trip blanks shall be subjected to the same analyses as the water sampled at the respective sampling sites. Trip blanks serve to indicate (1) if interaction between the sample and the container is occurring, (2) if a handling procedure alters the analytical results, and (3) if the sample bottles are being properly cleaned and rinsed by the analytical laboratory before field use.

Trip blanks shall be labeled TB-1 for the first blank, TB-2 for the second blank, etc. Appropriate information shall be recorded on the field log for each trip blank.

2.6.4 Blind Duplicates

A blind duplicate consists of a duplicate sample collected from a monitor well or surface-water sampling station. This duplicate is provided with an arbitrary sample number and is, therefore, submitted "blind" to the laboratory without their knowledge of which station the sample was obtained from. The dual set of samples from the same sampling location allows for detection of possible laboratory bias.

2.6.4.1 Groundwater Blind Duplicates

During each sampling campaign, 10 percent of the monitor wells shall be randomly selected for the collection of blind duplicates. A suite of sample bottles identical to those used at the randomly-selected monitor well shall be used for each blind duplicate. Both blind duplicate and actual sample bottles shall be filled at the same time using a sample

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splitter attached to the discharge tubing of the sampling pump, the bottom-emptying device of the bailer, or the discharge end of the filtering device (in the case of dissolved-metals samples). This sample splitter shall be constructed as indicated in Figure 2-7. Both sets of sample bottles (the actual sample and the blind duplicate) shall be handled, packed, preserved, and shipped in the same manner and in the same shipping container.

Groundwater blind duplicates shall be labeled GW-1 for the first duplicate of a sampling campaign, GW-2 for the second duplicate, etc. Sampling personnel shall document, in the field log book, all blind duplicates collected and the actual samples that they correspond to. This will allow subsequent correlation of the water chemistry data.

2.6.4.2 Surface-Water Blind Duplicates

During each sampling campaign, 10 percent of the surface-water sampling stations shall be randomly selected for the collection of blind duplicates. A suite of sample bottles identical to those used at the randomly-selected sampling station shall be used for each blind duplicate. Both blind duplicate and actual samples bottles shall be filled from the same sample ladle or from a sample splitter attached to the discharge end of the filtering device (in the case of dissolved-metals samples). If a sample splitter is used, it shall be constructed as outlined in Figure 2-7. Both sets of sample bottles shall be handled, packed, preserved, and shipped in the same manner and in the same shipping container.

Surface-water blind duplicates shall be labeled BW-1 for the first duplicate of a sampling campaign, BW-2 for the second duplicate, etc. Sampling personnel shall document, in the field log book, all blind duplicates collected and the actual samples that they correspond to. This will allow subsequent correlation of the water chemistry data.

2.6.5 New Equipment Issues

In the event that new equipment that will contact the samples is issued for use in the collection of water-quality samples (e.g., dedicated sampling pumps, bailers, etc.), this equipment shall be subjected to an equipment and field blank prior to initial use. This will ensure that potential contaminants used in the manufacture of the sampling or testing equipment are not present when it is first used at a sampling station. If multiple pieces of identical equipment are purchased at the same time from the same manufacturer (such as multiple pumps for dedicated installation), 10 percent of the individual pieces of equipment shall be randomly selected for testing, with a minimum of one test per equipment issue.

The blanks for new equipment issues shall be analyzed for the same chemical constituents as water samples collected in the field. The equipment shall not be used for sampling until the analytical results are received from the laboratory and these results indicate that the equipment is acceptable.

Pumps and bailers that will be used for the collection of groundwater-quality samples shall be tested by first decontaminating the equipment as outlined in Section 2.2. In the case of bailers, the bailer shall then be filled with distilled water and the distilled water shall be emptied into the appropriate sample bottles. The distilled water used for this purpose shall be obtained from a commercial source with a specific conductance that does not exceed 10 mmhos/cm at 25 °C. A field blank of the distilled water shall also be collected and analyzed.

In the case of pumps, the pump shall be lowered into a decontaminated stainless steel or Teflon tube with a diameter slightly larger than the pump. This tube shall be capped on the bottom to hold water. Distilled water (as described above) shall then be continuously poured into and pumped from the tube using the new pump. Pumping for this

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equipment blank shall continue for a period of 60 minutes (i.e., a time that is generally representative of purge times in the monitor wells). During this time, pH, specific conductance, and temperature measurements shall be taken of the discharging water every 15 minutes. Similar field measurements shall be taken of each separate container of distilled water used for the equipment blank. A field blank of the final container of distilled water shall also be collected.

In the case of surface-water equipment, distilled water (as described above) shall be poured into or over the decontaminated new piece of equipment. This distilled water shall then be emptied into the appropriate sample bottles. A field blank of the distilled water shall also be collected.

Equipment blanks and field blanks shall be labeled as described in Sections 2.6.1 and 2.6.2, respectively. Detailed records shall be kept and chain-of-custody procedures followed during the collection of these blanks as indicated in Section 2.4.

All pieces of new equipment issued for use at the site (whether or not involved in a pre-use test and including equipment for dedicated installation) shall be decontaminated prior to use as outlined in Section 2.2. This equipment shall then be stored in a manner that provides protection from contamination prior to use.

2.7 ACQUISITION OF SAMPLING SUPPLIES

Prior to beginning a sampling campaign, sampling personnel shall check all equipment to ensure that it is in proper working order. Personnel shall also inventory all disposable sampling supplies to determine quantities required to complete the upcoming sampling campaign. Equipment shall be maintained and repaired in accordance with the manufacturer's instructions.

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Disposable sampling supplies shall be ordered in sufficient quantity to provide an excess of each item required to complete the sampling round. Disposable supplies include:

- o Certified clean sample bottles with preservatives,
- o Shipping containers and packing material,
- o Required forms and labels,
- o Calibration solutions for pH and conductivity meters,
- o Disposable gloves and other safety equipment,
- o Filters and (potentially) filter holders,
- o Distilled water, and
- o Disposable paper towels.

Bottles required for sampling (with preservatives added) and ice chests shall be ordered directly from the analytical laboratory. Information concerning the bottle types required for various analytes will be provided by the laboratory.

2.8 RECORDS MANAGEMENT

The original signed and dated sample logs are an important part of the sampling record of the site. Sampling personnel shall periodically make a secondary copy of all log books and forms to provide a backup source of data in the event that the original copy is lost or destroyed.

The duplicate copies of all completed analysis request and chain-of-custody forms shall be filed daily with the project manager. All forms shall be kept on file for future program auditing and analysis review. These data shall be retained through the post-closure care period of each RCRA-regulated site.

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Field data shall be tabulated in a computerized data base as soon as practical after each sampling campaign. Information to be tabulated shall include pH, temperature, specific conductance, water level, and other data as appropriate for the sampled station. Data tables shall be designed to (1) group field parameters for each of the sampling stations during a given sampling campaign and (2) show historical trends for each set of parameters at a given sampling station.

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CHAPTER 3

COLLECTION OF GROUNDWATER ELEVATION AND FREE-PHASE HYDROCARBON THICKNESS DATA

3.1 INTRODUCTION

This section presents procedures for the collection of water-level and free-phase hydrocarbon thickness data from monitor wells. The collection of static water levels from monitor wells is important for determining the direction of groundwater flow beneath the site and, thus, aids in defining the extent of groundwater contamination.

Many of the monitor wells from which data will be collected have dedicated sampling pumps installed. The limited space between the outside of the dedicated pump and the inside of the well casing makes it impractical to access the bottom of the well to determine whether or not high specific-gravity fluids (commonly known as "sinters") have accumulated as a separate phase in the wells. However, historic data collected from monitor wells at the refinery have indicated that sinters are not present at the site.

The dedicated pumps have been installed with their intakes near (within approximately two feet of) the bottom of the wells. Thus, if sinters should they accumulate, a significant increase in the concentration of those constituents should be indicated in the monitor-well samples. If a significant unexplained increase in the concentration of a sinter is noted, the dedicated pumping system shall be pulled from the well and an interface probe shall be used to determine whether or not sinters have accumulated as a free phase in the bottom of the well.

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3.2 GENERAL PROCEDURES

Water-level data are used to indicate the shape of the groundwater surface at a point in time. To avoid variations caused by short-term fluctuations in the groundwater surface, and in compliance with Module IV, Section D.4 of the Permit, measurements shall be collected from all required monitor wells within twenty-four hours for each collection period.

To measure water levels, the locking cap which covers the well shall be removed and set aside in a clean sealable plastic bag or similar receptacle to ensure that the cap remains clean and contaminants are not introduced into the well via the cap. Sampling personnel shall stand upwind from the monitor wells during removal of the cap to minimize the potential for inhalation of vapors that may be present in the well and that could be a health detriment. Appropriate health and safety precautions (as outlined in the site health and safety plan) shall be taken while working near the monitor wells.

To avoid cross contamination during the collection of fluid-level measurements, the probe and cable of the measuring unit shall not be allowed to contact the ground surface or other sources of contaminants outside of the well. The probe and cable shall be thoroughly rinsed with distilled water prior to and after measurements are completed at each well and shall be visibly inspected during each use for foreign materials (e.g., soil, oil, etc.). If persistent residues exist, the probe and cable shall be decontaminated using the sensitive-equipment procedures outlined in Section 2.2.1.

All water-level and free-phase hydrocarbon measurements shall be collected relative to a surveyed point on each monitor well. This surveyed point shall be clearly marked on the monitor-well casing. It is important that each measurement be collected relative to the same point so that data can be properly interpreted. All water and hydrocarbon level

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measurements shall be collected to the closest 0.01 foot. These data shall be entered on the field log form.

Water-level and free-phase hydrocarbon measurements shall also be representative of static conditions. Thus, if the measurements are being collected as part of a groundwater sampling campaign, the measurements shall be collected prior to sampling of the wells, since the sampling process depresses the water level.

3.3 MEASUREMENTS USING AN INTERFACE PROBE

An interface probe uses an optical sensor and an electrical conductivity circuit to differentiate water from non-water liquids. The probe is attached to the surface via a cable, with the surface meter normally having two buzzers, two lights, or a combination of buzzers and lights to indicate when non-water liquids are encountered and when the water surface is encountered. Depth indicators on the device shall be permanently marked on the cable to prevent slipping during use.

The interface probe may displace a large amount of fluid in a 2- to 4-inch diameter monitor well. Although the probes are typically designed to account for this displacement, it is important to lower and raise the probe slowly to minimize the displacement effects.

When measuring fluid levels using an interface probe, the following procedures shall be used:

- o If a cable guide exists, place this guide on the edge of the monitor well casing.
- o Turn on the power switches for both the optical sensor and the electrical conductivity sensor.

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- o Slowly lower the probe into the liquid surface. If present, free-phase hydrocarbons will break the light beam on the optical sensor and activate a buzzer or light at the surface. Note on the field log form the level read from the cable (relative to the surveyed mark) at which the optical sensor was activated.
- o Continue to lower the probe slowly into the well until the water-level buzzer or light is activated. Note this level (relative to the surveyed mark) on the field log form.

The probe shall be raised and lowered slightly at each fluid level several times to ensure that the measurement is correct.

3.4 MEASUREMENTS USING A WATER-LEVEL INDICATOR

If at least three successive sampling-campaign measurements in a given monitor well have indicated that free-phase hydrocarbons are not present in that well, subsequent water-level measurements may be made using a water-level indicator. If future measurements or odors suggest that free-phase hydrocarbons may be present (e.g., oil or odor on the probe of the water-level indicator), liquid levels shall again be measured using an interface probe to determine whether or not free-phase hydrocarbons have accumulated in the well.

A water-level indicator typically consists of an electrical conductivity circuit which is completed when water is encountered. A buzzer or light at the surface is activated when the water surface is encountered. Depth indicators on the device shall be permanently marked on the cable to prevent slipping during use.

Care shall be taken to lower the cable of the water-level indicator in such a way that the cable does not rub on the edge of the well casing and thus damage the cable. As soon as the probe contacts the water surface, the surface meter will be activated. As

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with the interface probe, the probe of the water-level indicator shall be carefully raised and lowered following initial contact with the water surface to ensure that the water-level measurement is accurate. Once the probe is retracted from a well it shall be sprayed off with distilled water and gently wiped with a disposable paper towel before insertion into the next well. Additionally, the probe will be decontaminated prior to measuring the first well during a sampling event and again at the end of the event. Decontamination procedures outlined in Section 2.2.1 for sensitive equipment will apply to the water level indicator.

3.5 MEASUREMENTS AT FLOWING WELLS

The hydrostatic pressure at some monitor wells at the site is sufficient to cause the wells to flow at the surface. To collect fluid-level measurements in these wells, the wells shall be fitted with a temporary cap similar to that shown in Figure 3-1. Each flowing well shall have its own dedicated cap.

The tubing attached to the cap shall be extended vertically and the valve shall be opened. Once the fluid level stabilizes in the tubing, the height of the water level above the surveyed reference point shall be measured. The thickness of free-phase hydrocarbons in the tubing (if present) shall also be noted.

3.6 WELL DEPTH MEASUREMENTS

In accordance with Module IV, Section D.2.g of the Permit, the depth to the bottom of each monitor well shall be measured annually to the nearest 0.1 feet. This shall be accomplished by first removing the dedicated pumps and storing them in a clean environment. Then, using a well probe or other decontaminated measuring device that can detect the top of any loose sediment that may have built up in the well, the depth is

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measured and recorded on the field logs. The measurement is compared to the initial completion depths listed on Tables 3-1 and 3-2 and shall be recorded on the groundwater field log. The comparisons shall be presented in the appropriate groundwater sampling reports.

CHAPTER 4

GROUNDWATER QUALITY SAMPLING

4.1 INTRODUCTION

This chapter provides methods for the collection of groundwater-quality samples from monitor wells included in the Permit. A flow chart is provided in Figure 4-1, which outlines general activities to be performed during the collection of groundwater samples. Selected well-completion details for the Permit monitor wells are summarized in tables 3-1 and 3-2.

Equipment required to sample a monitor well includes:

- o Interface probe or water-level indicator,
- o Portable pH and temperature meter,
- o Portable specific conductance meter,
- o Calibration solutions,
- o Filtration equipment and supplies,
- o Calibrated container to measure the discharge rate,
- o Flow cell,
- o Waterproof gloves,
- o Pressure-control unit for dedicated bladder pumps,
- o Bailers for flowing wells,
- o Sample bottles, and
- o Health and safety monitoring equipment and supplies.

In addition, for non-flowing wells not equipped with dedicated pumps, portable sampling pumps and tubing bundles will be required.

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4.2 SAMPLING ORDER OF MONITOR WELLS

Monitor wells shall be sampled starting with the least-contaminated well and progressing to the most-contaminated well. Typically, this will occur from an upgradient to a downgradient direction. Sampling in order of increasing contamination reduces the potential for cross-contamination between wells.

For the GWMA wells, the initial sampling order for the monitor wells shall be as follows: (1) S-5 (2) S-35, (3) S-4A, (4) S-24, (5) S-1, (6) PCP-1, (7) PCP-2, (8) PCP-3, (9) PCP-4 and (10) PCP-5. For the RWMA Post Closure Wells, the sampling order for the monitor wells shall be as follows: RWMA-1 through 4. For the LWMA post remediation wells, the sampling order shall be LWMA-1 through 4.

This sampling order may be revised by the project manager if subsequent data, or facility access restrictions indicate a need. In addition, monitor wells not specifically associated with the Permit or post closure monitoring may periodically be sampled. Therefore, sampling personnel shall interface with the project manager prior to each groundwater sampling campaign to verify the sample order.

4.3 WELL PURGING AND SAMPLE COLLECTION

4.3.1 Health and Safety Considerations

During sampling operations, personnel shall remain upwind from the well to minimize the potential for inhalation of organic vapors that may be present in the well. All sampling operations shall be conducted in a manner that complies with the site health and safety plan. Thus, in addition to the collection of groundwater data from the monitor

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wells, health and safety data shall be collected as required to ensure the safety of the sampling personnel.

4.3.2 Pre-Sampling Operations

Prior to sampling, all meters and other equipment that are used at multiple wells shall be decontaminated and calibrated. Decontamination procedures are outlined in Section 2.2. Meters shall be calibrated prior to measurements at each well in accordance with Section 2.3.

Prior to the collection of water-quality samples from the monitor wells, the depths to the top of any free-phase hydrocarbon surface and the water surface shall be determined in accordance with the procedures outlined in Chapter 3. For wells that are not equipped with dedicated sampling pumps, the depth to the bottom of the casing shall also be determined as a measure of the integrity of the well. This depth measurement shall be made using the methods detailed in Section 3.6.

Following collection of the fluid-level data, the volume of water standing in the well casing (referred to herein as the "casing volume") shall be determined according to the following equations:

$$\text{For 2-inch diameter wells: } V_c = 0.16(D_{\text{well}} - D_{\text{water}}) \quad (4-1)$$

$$\text{For 4-inch diameter wells: } V_c = 0.65(D_{\text{well}} - D_{\text{water}}) \quad (4-2)$$

$$\text{For 5-inch diameter wells: } V_c = 1.02(D_{\text{well}} - D_{\text{water}}) \quad (4-3)$$

where V_c = one casing volume (gal)
 D_{well} = depth to the bottom of the well (ft)
 D_{water} = depth to the top of the groundwater surface in the well (ft)

The calculated casing volume shall be entered on the field log form and will be used during subsequent well-purge operations prior to sampling.

The depth to the bottom of the well shall be measured annually during the spring sampling event as detailed in Section 3.6. The previous spring well depth measurements will be used during the fall sampling event to determine the casing volumes for purge water calculations.

Where dedicated sampling pumps have been installed, the potential for sediment to have entered and accumulated in the bottom of the well shall be monitored by observing the discharge from the pump during purging and sampling operations. If the turbidity of the discharge water increases significantly (based on visual observations), the pump shall be pulled and the well depth shall be measured. If sediment has accumulated, the well shall be cleaned. The pump shall then be replaced.

4.3.3 Sampling Free-Phase Hydrocarbons

If free-phase hydrocarbons ("floaters") are detected during water-level measurements, these floaters shall be sampled prior to groundwater sampling using a peristaltic pump. If the viscosity of the floater prevents sampling with a peristaltic pump, the floater shall be sampled with a top-entry stainless-steel or Teflon bailer.

Down-hole tubing used with a peristaltic pump shall be constructed of Teflon and shall have a flow-through stainless steel tubing weight attached to the bottom end. To sample a floater, the Teflon tubing (with the tubing weight attached) shall be lowered carefully to a depth that is just less than that of the floater/water interface. The floater shall then be slowly pumped to the surface and discharged into 40 ml glass vials with

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Teflon-lined septa (commonly referred to as "VOA" bottles because of their use for volatile organic analyses).

If a bailer is used to collect the free-phase hydrocarbon sample, the bailer shall be lowered slowly through the free phase to a depth where the top of the bailer is just below the top of the free-phase hydrocarbon. Following filling, the bailer shall be raised to the surface and the free-phase hydrocarbon shall be slowly emptied into the VOA bottles.

The VOA bottles shall be filled slowly until they are approximately one-half to two-thirds full. Filling the vial to a greater depth with a free-phase hydrocarbon could cause the vial to burst as a result of thermal expansion of the fluid (Maine Department of Environmental Protection, 1989). Once the vial is filled to the proper depth, it shall be immediately capped. The sample shall then be handled as indicated in Chapter 2. Free-phase samples shall be stored and shipped in containers separate from those used to store and ship water samples, thus minimizing the potential for cross contamination between the samples as a result of volatilization.

Following collection of the floater, any tubing used for sample collection shall be discarded and the tubing weight shall be decontaminated. Bailers used for sample collection shall be decontaminated.

4.3.4 Well Purging

4.3.4.1 Purge Operations

Purging of the monitor wells prior to sampling is necessary to remove stagnant and stratified water from the well casing. Purging results in a sample that is representative of

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the monitored aquifer. Purging shall occur after measurement of fluid levels and prior to sampling.

Purging consists of evacuating a quantity of water from the well equal to at least three casing volumes. For non-flowing wells, purging shall be conducted using the sampling pumps. For flowing wells, purging shall be conducted by allowing the well to flow. For wells which have a specially installed drop tube due to excessive light non-aqueous phase liquid material floating on top of the water in the well, purging shall be conducted using a Teflon bailer. The bailer shall be lowered through the drop tube on stainless-steel or Teflon-coated cable, allowed to fill with water and raised, either manually or by a mechanical winch or hoist that has been decontaminated pursuant to Section 2.2.2. The cable shall be prevented from contacting the ground surface. Water that is removed from the wells during purging shall be disposed of as indicated in Section 4.3.4.2.

Pumps used for purging and sampling at the Salt Lake Refinery shall be bladder pumps that are constructed of Teflon and stainless steel. These pumps operate by introducing compressed air into the Teflon "bladder" on the interior of the pump. This squeezes water, that has accumulated in the pump, up and out the discharge tubing. The compressed air is then vented and the pump re-fills. This cycle continues in order to pump water to the surface. Tubing used to convey compressed air to the pump and water from the pump shall be constructed of Teflon, with stainless-steel fittings, where the sample or the well water may contact the tubing.

Compressed air used for the bladder pump shall consist of bottled nitrogen or air from an oil-less compressor. If the system is driven by means of an air compressor, the compressor shall be connected to a regulated air tank to provide a steady flow of air to the pump.

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Lines from the compressed-air source and pump shall be connected to the pressure-control ("logic") unit in accordance with the manufacturer's instructions. Operation of the bladder pump requires that the pressure at the pump be sufficient to compensate for the depth of the pump. This pressure shall be calculated using the following formula:

$$P = 0.5H + 10 \quad (4-4)$$

where P = air pressure to the pump (psi)

H = depth to the top of the pump (ft)

The minimum operating pressure shall initially be 50 psi when an electronic logic unit is used and 70 psi when a pneumatic logic unit is used.

All bladder pumps and logic units shall be operated in accordance with the manufacturer's instructions. During purging, the pressure shall initially be set in accordance with Equation 4-4. After the pump is operating, the volume of water being discharged during each pressure cycle shall be measured. Once a stable cycle volume has been determined, the "Pump Refill" control on the logic unit shall be reduced until the volume of water discharged per cycle just starts to decrease. Then, the "Water Discharge" control shall be turned down until the controller switches just as the water discharge stops.

If the yield of the well is less than the capacity of the pump, the discharge rate during purging will drop or be sporadic. In this case, the compressed-air pressure shall be slowly decreased after the above procedure until a stable flow rate is achieved. The "Water Discharge" control shall be increased if necessary to maintain a satisfactory volume per cycle.

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During initial purging (whether by pumping or by allowing the well to flow), the time required to fill a container of known volume shall be determined. The discharge rate shall then be calculated by dividing the volume of the container (in gallons) by the time required to fill the container (in minutes). The amount of time (in minutes) required to purge three casing volumes shall be calculated by dividing the three-casing volume (in gallons) by the flow rate (in gallons per minute). During purging, field water-quality measurements shall be collected of the purge water every 15 minutes using the procedures outlined in Section 2.3.

In those cases where the yield of the well is sufficiently low that a constant discharge rate cannot be maintained during pumping, the well shall be purged until it dewateres. Field water-quality measurements shall be collected of the discharge water at least once during purging of the low-yield wells. Once the well is dewatered, it shall be considered completely purged. The pump shall be left in the well and the well shall be allowed to recover sufficiently to permit sampling (i.e., at least until the body of the bladder pump is completely submerged).

4.3.4.2 Micro-Purge

On low yield wells, the use of micro-purge methods may be used. This method is incorporated where purging three casing volumes of water may require that samples not be collected for several hours or days after purging. In some cases, the field measurement parameters (pH, conductivity, temperature) may stabilize before three casing volumes have been removed. Under these conditions, micro purging may allow collection of samples much earlier without the potential sample alteration caused by having to wait for the well to recover.

Another justification for the use of micro-purge methods is when purging three casing volumes from the well may drop the water level below the desired interval forcing the water to fall or cascade down the well column. This effect could result in volatilization of certain constituents, which may affect the accuracy of water chemistry results. Micro-purge methods result in minimum drawdown during purging. The water flows through a flow cell where field water-quality parameters are measured and recorded as noted in Chapter 4. Once the flow cell measurements have stabilized to within 0.02 pH units on three consecutive readings, samples are then collected in the usual method.

If micro-purge techniques are used, the appropriate reference will be made on the field log forms.

4.3.4.3 Purge Water Disposal

All purge water from shallow aquifer wells will be collected in drums, labeled with the well number, date and time of collection and sealed closed. If resulting laboratory analytical tests indicate that the water meets acceptance criteria for the refinery Wastewater Treatment System (WWTS) it shall be disposed of at the nearest inlet to the WWTS. If the water fails the WWTS acceptance limits, arrangements shall be made or off-site disposal.

4.3.5 Sample Collection

Sampling shall occur immediately after purging is completed. Waterproof disposable gloves shall be worn during sampling to prevent sample contamination and skin contact with possible contaminants. These gloves shall be disposed of after sampling activities are completed at each well.

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During purging and sampling operations, sample bottles shall not be placed on the ground surface or in an area where the bottles may be splashed upon (Section 2.5.1). This will minimize the potential for inadvertent contamination of the samples. Caps and protective sleeves shall not be removed until immediately prior to bottle filling to prevent contamination or breakage of sample bottles.

Groundwater samples shall be collected directly from the Teflon discharge line following purging for wells equipped with bladder pumps (dedicated or portable). For flowing wells or wells equipped with a drop tube, a dedicated Teflon point-source bailer shall be used to collect the sample following purging. The bailer shall be lowered on stainless-steel or Teflon-coated cable to a depth within the screened section of the well. This cable shall be attached to a reel to permit lowering and raising of the bailer without the cable contacting the ground surface.

Once the bailer is lowered to the desired level, it shall be removed from the well. A valved bottom-emptying device shall then be inserted into the bottom of the bailer and the valve opened to fill the sample bottles. Additional sample shall be retrieved with the bailer if needed to fill all of the sample bottles.

Sample bottles shall be filled in the following order:

1. Volatile organics
2. Semi-volatile organics
3. General Parameters
4. Total metals (unfiltered sample) *
5. Dissolved metals (filtered sample)

* Total metals are not specified in Permit Module IV-C. However, follow this order for other specialized sampling at the facility where they are specified.

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During the collection of samples for volatile organics, the discharge rate from the dedicated pumps shall not exceed 100 ml per minute (0.03 gallon per minute) to minimize volatilization of the sample. The discharge from low-yield wells that are purged to dryness shall also be kept to a minimum to minimize the potential for dewatering the well during sampling. The flow rate from the bladder pump shall be reduced in accordance with the manufacturer's instructions by decreasing the air pressure, adjusting the "Water Discharge" control, and using the throttle valve.

Bottles in which sample portions are collected for analysis of volatile organics shall be allowed to briefly overflow and form a convex meniscus and immediately capped without headspace. The bottle shall be turned upside-down after it is capped to check for headspace. If bubbles appear in the bottle and there are no preservatives, the bottle shall be emptied to the same location as the purge water and re-filled. If there are preservatives, the bottle shall be discarded and replaced with a new bottle to be filled in the same fashion with no air bubbles.

The pumping rate may be increased for filling the remaining bottles after the volatile organics samples have been collected. However, the sampling rate shall not exceed the rate at which the well was purged. If analyses are to be performed for dissolved metals, the sample shall be collected and filtered as outlined in Section 2.5.1.

During purging and sampling, all appropriate information shall be entered on the field log form. Chain-of-custody, sample handling, and field quality-control procedures shall be followed as indicated in Sections 2.4, 2.5, and 2.6, respectively.

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CHAPTER 5

SURFACE-WATER QUALITY SAMPLING

5.1 INTRODUCTION

This chapter presents methodologies for the collection of surface-water samples and related field data. Protocols for the collection of two basic types of surface-water samples (grab samples and pond samples) are described. A flow chart of general surface-water sampling protocols is provided in Figure 5-1.

5.2 SAMPLING SITE SELECTION

Surface-water samples shall be collected at the locations indicated in the Permit. However, sampling schedules, stations, and analytical parameters may change periodically as data are collected or regulatory requirements change. Therefore, the Chevron project manager shall be contacted prior to sampling to determine appropriate sampling stations, parameters, etc.

Where feasible, sampling locations shall be marked in the field to permit future re-sampling at the same location. This will allow trends at a given location to be determined if repeat sampling is anticipated.

In the case of grab-samples, the station shall be marked with a survey stake and the station number shall be indicated with a waterproof marker on the stake. In the case of pond samples, the station shall be marked with a buoy constructed from an empty one-gallon plastic jug that is attached with nylon cord to a weight at the bottom of the pond. The jug shall be marked with waterproof ink to indicate the station number.

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5.3 HEALTH AND SAFETY CONSIDERATIONS

Whenever feasible during sampling operations, personnel shall remain upwind from the sampling station to minimize the potential for inhalation of organic vapors that may be present at the site. All sampling operations shall be conducted in a manner that complies with the site health and safety plan. Thus, in addition to the collection of surface-water data, health and safety data shall be collected as required to ensure the safety of the sampling personnel.

Sampling personnel shall wear personal protective equipment that is appropriate to the sampling station (see the site health and safety plan). At a minimum, this will include clean, disposable waterproof gloves to prevent contamination of samples or skin contact with possible contaminants. Additional safety equipment, including waterproof boots, coveralls, and splash shields, shall be worn if water at a sampling station is suspected of being contaminated.

5.4 GRAB SAMPLE COLLECTION

5.4.1 Sampling Equipment

A grab sample represents an instantaneous measurement of conditions at a particular location. Equipment required to collect grab samples and measure field parameters at surface-water sampling stations includes:

- o Portable pH and temperature meter,
- o Portable specific conductance meter,
- o Calibration solutions,
- o Filtration equipment and supplies,

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- o Stainless steel ladle,
- o Sample bottles,
- o Waterproof gloves and boots,
- o Safety glasses or splash shield, and
- o Health and safety monitoring equipment and supplies.

All equipment and instruments which may contact the water to be sampled must be thoroughly decontaminated prior to use at each sampling station and following use at the final station to be sampled during a given round. Decontamination shall be in accordance with the procedures outlined in Section 2.2. Instruments shall be calibrated at each station. Calibration procedures are outlined in Section 2.3.

5.4.2 Measurement of Field Parameters

The measurement of field parameters from each grab sampling station shall be performed just prior to sample collection. The field parameters to be measured are pH, temperature, and specific conductance. All parameters shall be measured at the sampling point using the procedures presented in Section 2.3.

5.4.3 Sample Collection

Sample bottles shall be stored off the ground surface at the sampling station to prevent sample bottles from being contaminated by materials on the ground. Bottle caps and protective foam shall not be removed until immediately prior to bottle filling to prevent contamination or breakage of sample bottles.

Sampling personnel shall work at a location from which they can safely reach both the sample collection point and the sample bottles. Sample bottles shall be filled using a

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stainless-steel ladle. This ladle shall have been decontaminated prior to each use in accordance with Section 2.2. The bowl portion of the ladle shall have a pouring spout to prevent unnecessary sample spillage during transfer operations.

The sample decontaminated ladle shall be stored prior to use in a plastic bag to prevent contact with the ground surface or other areas of potential contamination. Care shall be exercised during filling of the sample ladle to avoid contact of the ladle with the soil beneath the water being sampled (e.g., the bottom of the ditch, pond, etc.), thus preventing the introduction of sediment into the sample. If sediment is inadvertently introduced into the sample, the ladle shall be rinsed with distilled water and an alternate location shall be sampled immediately adjacent to the initial location but outside the area affected by the agitated sediment.

Sample bottles shall be carefully filled by pouring water from the ladle directly into the sample bottle. During bottle filling, the ladle shall not rest on the mouth of the bottle, thus preventing possible contamination of the sample by foreign material on the ladle or by preservatives in the bottles. In addition, the height of the ladle above the bottle shall be minimized during transfer to prevent unnecessary aeration of the sample.

Sample bottles shall be filled in the following order:

1. Volatile organics
2. Semi-volatile organics
3. General constituents
4. Total metals (unfiltered sample)
5. Dissolved metals (filtered sample)

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With the exception of the VOA bottles, sample bottles shall be filled to capacity with care being taken to prevent overflowing and spilling of preservatives. All sample bottles shall be filled as completely as possible to reduce the potential for volatilization or aerobic activity prior to sample analysis.

VOA bottles shall be filled to overflowing with a convex meniscus forming at the mouth of the bottle. The caps shall then be immediately and firmly attached and the bottle overturned and tapped gently to check for air bubbles. If bubbles are present, and there are no preservatives in the bottle, the bottle shall be emptied and re-filled. With preservatives, the bottle shall be discarded and replaced with a new bottle. The bottle shall again be overturned and tapped to check for air bubbles. This procedure shall be repeated until no air bubbles are visible within the VOA bottles.

During sampling, all appropriate information shall be entered on the field log form. Chain-of-custody, sample handling, and field quality-control procedures shall be followed as indicated in Sections 2.4, 2.5, and 2.6, respectively.

5.5 POND SAMPLE COLLECTION

5.5.1 Sampling Equipment

Samples may be collected at the site from large standing bodies of water that may require the use of a boat to obtain a representative sample of the water. Equipment required for the collection of these pond samples includes that which was required for the collection of grab samples plus the following:

- o Fiberglass or aluminum boat with oars and anchor (if required),
- o Life vests (one per person if boat is used),

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- o Teflon point-source bailer with Teflon dump valve,
- o 2- to 5-gallon glass narrow-mouth bottle,
- o Stainless steel funnel, and
- o Teflon sheeting.

All equipment which contacts the water must be decontaminated before it is used in sampling and field-parameter measurement. Decontamination procedures shall be in accordance with Section 2.2. Instruments shall be calibrated at each pond in accordance with Section 2.3.

Special care shall be taken when cleaning the narrow-mouth glass bottles that are used for compositing samples collected from a pond. Since these bottles are normally composed of non-tempered glass, they may shatter during steam cleaning if they are not handled properly. The bottle shall be gradually warmed by alternating the steam-cleaner nozzle between the inside and outside of the bottle as the water in the steam cleaner is warming. This spraying operation shall continue until the discharge from the steam-cleaner wand changes to steam. The bottle shall then be carefully emptied of water and steam spraying shall be alternated between the exterior and interior of the bottle. During the cleaning process, caution shall be used to avoid plugging the bottle opening with the steam wand. Plugging the opening could allow pressure to build up within the bottle and cause the bottle to shatter.

5.5.2 Measurement of Field Parameters

Field parameters to be measured at ponded-water stations shall include pH, water temperature, specific conductance, and depth of water at the sampling station. These measurements shall be performed on the individual water samples collected from each station within the pond as well as on the final composited sample.

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Field parameters shall be measured at the same positions on the body of water from which samples are collected. All measurements shall be performed as outlined in Section 2.3.

Pond depth measurements shall be obtained by reading the water level indicated on existing staff gauges or by using a weighted fiberglass tape marked in tenths of a foot. Measurements shall be taken prior to collection of the water sample and after the boat has been securely anchored. If a measuring tape is used, the weighted tape shall be allowed to gently tag bottom, after which the tape shall be carefully raised and lowered to insure that true bottom was reached.

5.5.3 Sample Collection

The collection of pond samples and measurement of the field water-quality parameters shall be performed immediately following the collection of the depth measurements. Pond sampling operations shall be performed with a minimum of two personnel in the boat at all times. Each person shall wear a life vest.

After the depth measurement is recorded, the point-source bailer shall be lowered on a stainless steel or Teflon-coated cable at a slow rate until it reaches a point approximately halfway to the bottom or approximately four inches above the bottom of the pond, whichever depth is less. Care shall be exercised when lowering the bailer to avoid contact with the bottom sediment. The cable shall be attached to a reel to permit untangled lowering and raising of the bailer.

After reaching the required depth, the bailer shall be retrieved. The bottom of the bailer shall then be carefully positioned on a clean plastic sheet and the Teflon dump valve

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shall be removed from its protective plastic bag and attached to the bailer. Approximately one cup of water shall be discharged to the water over the edge of the boat to determine if sediment entered the bailer during sampling.

If water exiting the valve is clear of bottom sediment, a portion of the water shall be collected for measurement of field parameters (in accordance with Section 2.6) and the remainder shall be slowly emptied into the large narrow-mouth glass compositing container. If water exiting the bailer is turbid due to the presence of bottom sediment, the bailer shall be emptied back into pond and a sample shall be collected from the opposite side of the boat. This procedure shall be performed each time the bailer is pulled from the water to ensure that sediment is not lodged in the base of the bailer.

When discharging the contents of the bailer into the compositing bottle, care shall be exercised to minimize the turbulence of the sample. Additional bailers of water shall be collected as necessary to fill the bottle to its required volume. This volume is dependent on the number of sample stations within the pond and the required volume of the final sample (e.g., if two gallons of sample is required and four sample stations will be used, fill the compositing bottle with one-half gallon of water from each station within the pond). Following collection of water from each station within the pond, the compositing bottle shall be tightly capped with a sheet of thin Teflon sheeting and a clean plastic cover. This cap shall be attached to the bottle using polyethylene tape.

Care shall be taken to avoid spilling or unnecessary agitation of the sample water in the compositing bottle during bottle filling operations. The compositing bottle shall be shrouded with a piece of opaque material during sample collection to prevent exposure to sunlight.

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After collection of field data and water samples from all sampling stations at the pond, sampling personnel shall return to the shore where the individual sample bottles will be filled. The compositing bottle shall be carefully removed from the boat and placed on a smooth surface adjacent to the sample bottles. The pre-labeled and preserved sample bottles shall be assembled in an area above the ground surface. The bottles shall remain capped until filling to minimize the potential for sample contamination.

Prior to filling the sample bottles, the compositing bottle shall be slowly agitated in a vertical position using a circular motion. Extreme caution shall be used during this procedure to insure that the bottle does not slip and break. The bottle shall be agitated until the water is visibly well-mixed.

The polyethylene tape, plastic cap, and Teflon sheeting covering the compositing bottle shall be removed after the sample is well mixed. The water from the compositing bottle shall then be poured slowly (to prevent turbulence) into a previously-decontaminated stainless-steel ladle. The first portion of water from the compositing bottle shall be used to rinse the ladle then discarded into the pond. The ladle shall then be filled, with a portion of the composited sample being used to measure the field pH, temperature, and specific conductance (see Section 2.6). The remainder of the water in the ladle and the compositing bottle shall be used to fill the sample bottles. The compositing bottle shall be gently agitated for 5 seconds between each ladle filling to ensure that the water sample remains well-mixed.

Sample bottles shall be filled from the compositing bottle in the following order:

1. Volatile organics
2. Semi-volatile organics
3. General constituents

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- 4. Total metals (unfiltered sample)**
- 5. Dissolved metals (filtered sample)**

With the exception of the VOA bottles, sample bottles shall be filled to capacity with care being taken to prevent overflowing and spilling of preservatives. All sample bottles shall be filled as completely as possible to reduce the potential for volatilization or aerobic activity prior to sample analysis.

VOA bottles shall be filled to overflowing with a convex meniscus forming at the mouth of the bottle. These bottles shall be checked for the presence of air as outlined previously. Depending on whether there are preservatives in the bottle, it shall either be emptied and re-filled or discarded and replaced with a new preserved bottle.

During sampling, all appropriate information shall be entered on the field log form. Chain-of-custody, sample handling, and field quality-control procedures shall be followed as indicated in Sections 2.4, 2.5, and 2.6, respectively.

CHAPTER 6

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TABLES

TABLE 1-1

GROUNDWATER ANALYTE LIST FOR THE RWMA, LWMA AND GWMA

General Parameters	Metals	Volatile Organics	Semi-Volatile Organics
Calcium Magnesium Potassium Sodium Sulfate Chloride Alkalinity Nitrate + Nitrite as N Fluoride Sulfide pH Specific Conductance Total Dissolved Solids Oil and Grease	Arsenic Cadmium Chromium Lead	Benzene Ethylbenzene Toluene Xylenes ¹	Benzenethiol 2,4-Dimethylphenol ²

- 1) Reported as ortho-, meta-, and para- isomers.
- 2) To be performed only at LWMA-2. Elimination of this sampling analysis shall be considered when a valid trend of certainty can be justified and analytical anomalies cease for three consecutive annual sampling events.

TABLE 2-1
SAMPLE PRESERVATION REQUIREMENTS^(a)

Parameter	Preservative	Maximum Holding Time
Field Parameters		
pH, Temperature, Specific Conductance	None	Analyze Immediately
General Parameters		
pH, Specific Conductance	Cool to 4°C	ASAP
Alkalinity, Bicarbonate	Cool to 4°C	14 days
Chloride, Fluoride, Sulfate	Cool to 4°C	28 days
Nitrate + Nitrite (as N) Oil & Grease	Cool to 4°C, H ₂ SO ₄ to pH<2	28 days
Sulfide	Cool to 4°C, add ZnAC and NaOH to pH>9	7 days
Total Dissolved Solids	Cool to 4°C	7 days
Metals		
All Metals ^(b) Except Mercury	HNO ₃ to pH<2	6 months
Volatile Organics		
All Volatile Organics	Cool to 4°C, HCL	14 days
Base/Neutral Organics		
All Base/Neutral Organics	Cool to 4°C	7 days to extract, 40 days to analyze
Acid Organics		
All Acid Organics	Cool to 4°C	7 days to extract, 40 days to analyze

^(a) Table to be updated if analyte list or EPA standards changes.

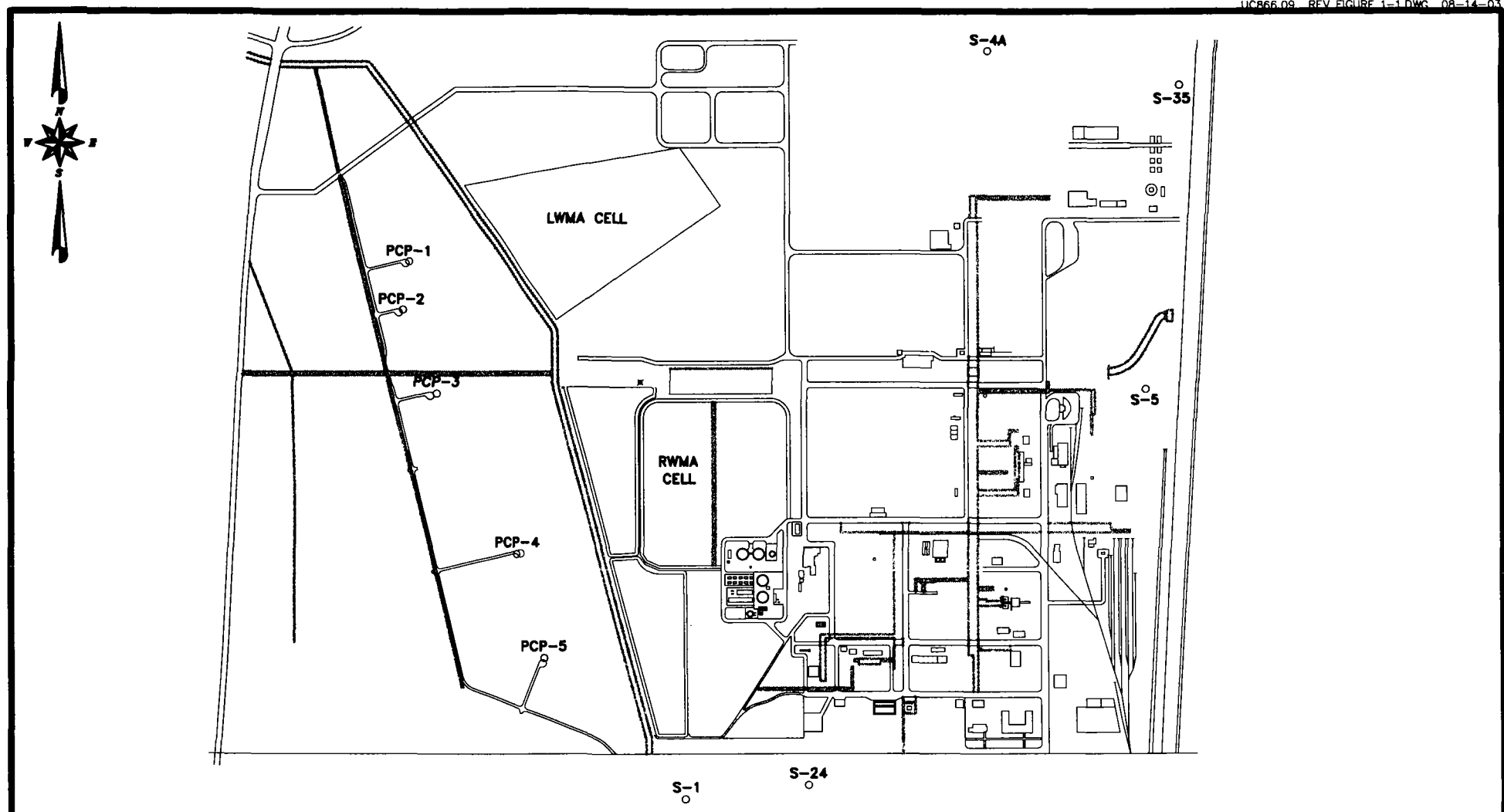
TABLE 3-1
GWMA MONITOR WELL
COMPLETION SUMMARY

Well Number	Well Depth (ft)	Well Diameter (in)	Screened From (ft)	Screened To (ft)	Slot Aperture (in)
S-1	15.0	2	1.0	15.0	0.010
S-4A	18.0	2	2.7	17.7	0.010
S-5	15.0	2	2.0	15.0	0.010
S-24	11.3	2	1.3	11.3	0.016
S-35	16.0	2	4.0	16.0	0.016
PCP-1	17.0	2	1.5	16.5	0.010
PCP-2	20.0	2	10.0	20.0	0.010
PCP-3	18.0	2	3.0	18.0	0.010
PCP-4	25.0	2	2.5	22.5	0.010
PCP-5	18.0	2	3.0	18.0	0.010

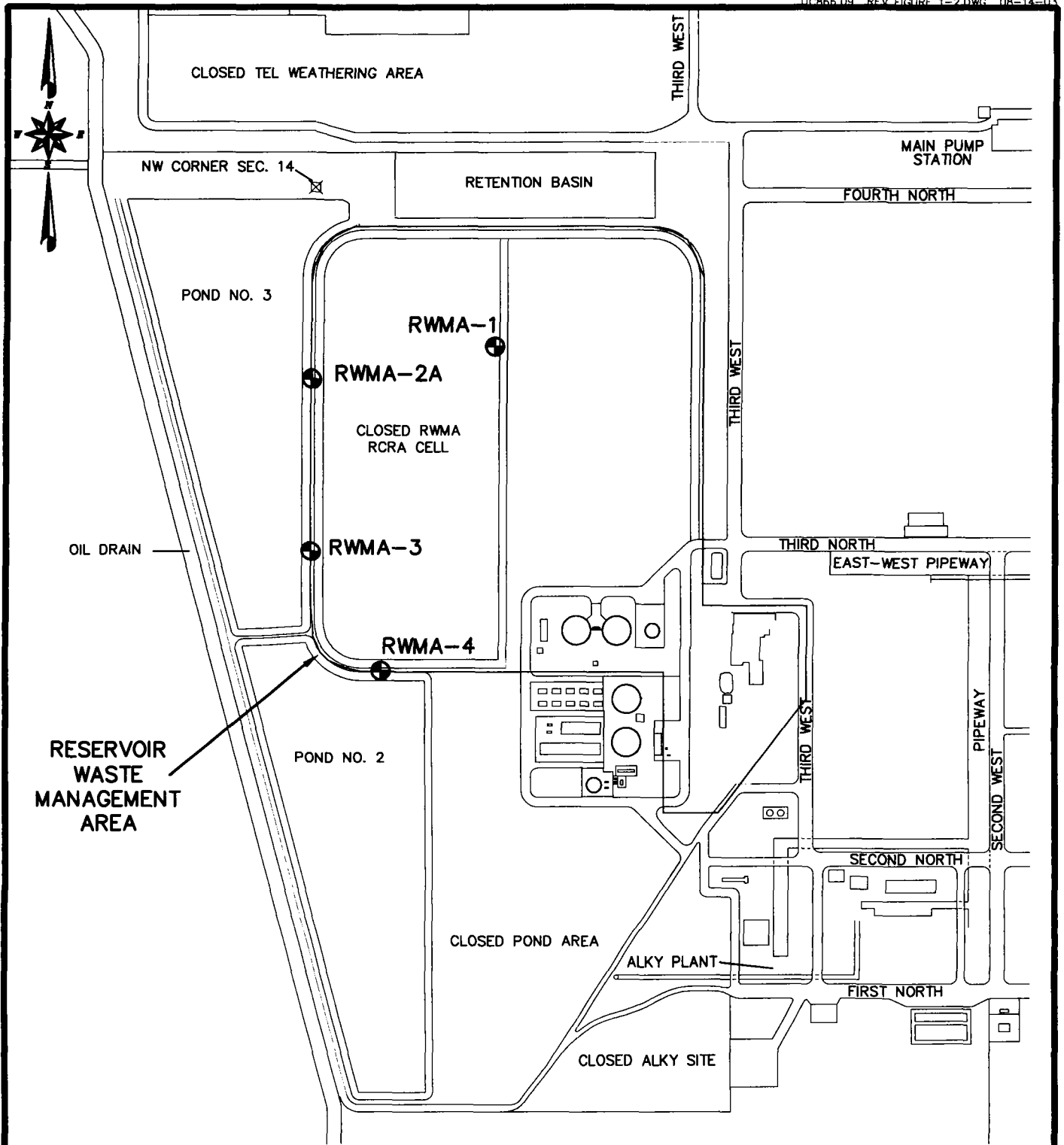
TABLE 3-2
RWMA and LWMA MONITOR WELL
COMPLETION SUMMARY

Well Number	Well Depth (ft)	Well Diameter (in)	Screened From (ft)	Screened To (ft)	Slot Aperture (in)
RWMA-1	25.0	2	9.5	25.0	0.010
RWMA-2A	25.6	2	10.0	25.0	0.010
RWMA-3	25.0	2	10.0	25.0	0.010
RWMA-4	23.5	2	8.5	23.5	0.010
LWMA-1	40.9	2	10.9	40.9	0.010
LWMA-2	41.9	2	11.9	41.9	0.010
LWMA-3	41.6	2	11.6	41.6	0.010
LWMA-4	40.9	2	10.9	40.9	0.010

FIGURES



		Chevron Products Company Salt Lake Refinery		POST CLOSURE PERMIT ATTACHMENT 1 LOCATION OF GWMA COMPLIANCE WELLS				
DR _____ CH. _____	OPR'G. DEPT.	APPROVED _____	SCALE $1" = 800'$ DATE 08-14-03	REV	<div style="border: 1px solid black; width: 20px; height: 20px; margin: 2px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 2px;"></div>			FIGURE 1-1
DR APP. _____	ENG'R. DEPT.		C.C. _____ S.O. _____					
ENGR. _____								



REV



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Chevron
Salt Lake Refinery

Products Company

DR SWF CH. BRD

DR APP. SWF

ENGR. BRD

OPR' G. DEPT. APPROVED

ENG' R. DEPT.

POST CLOSURE PERMIT

ATTACHMENT 1

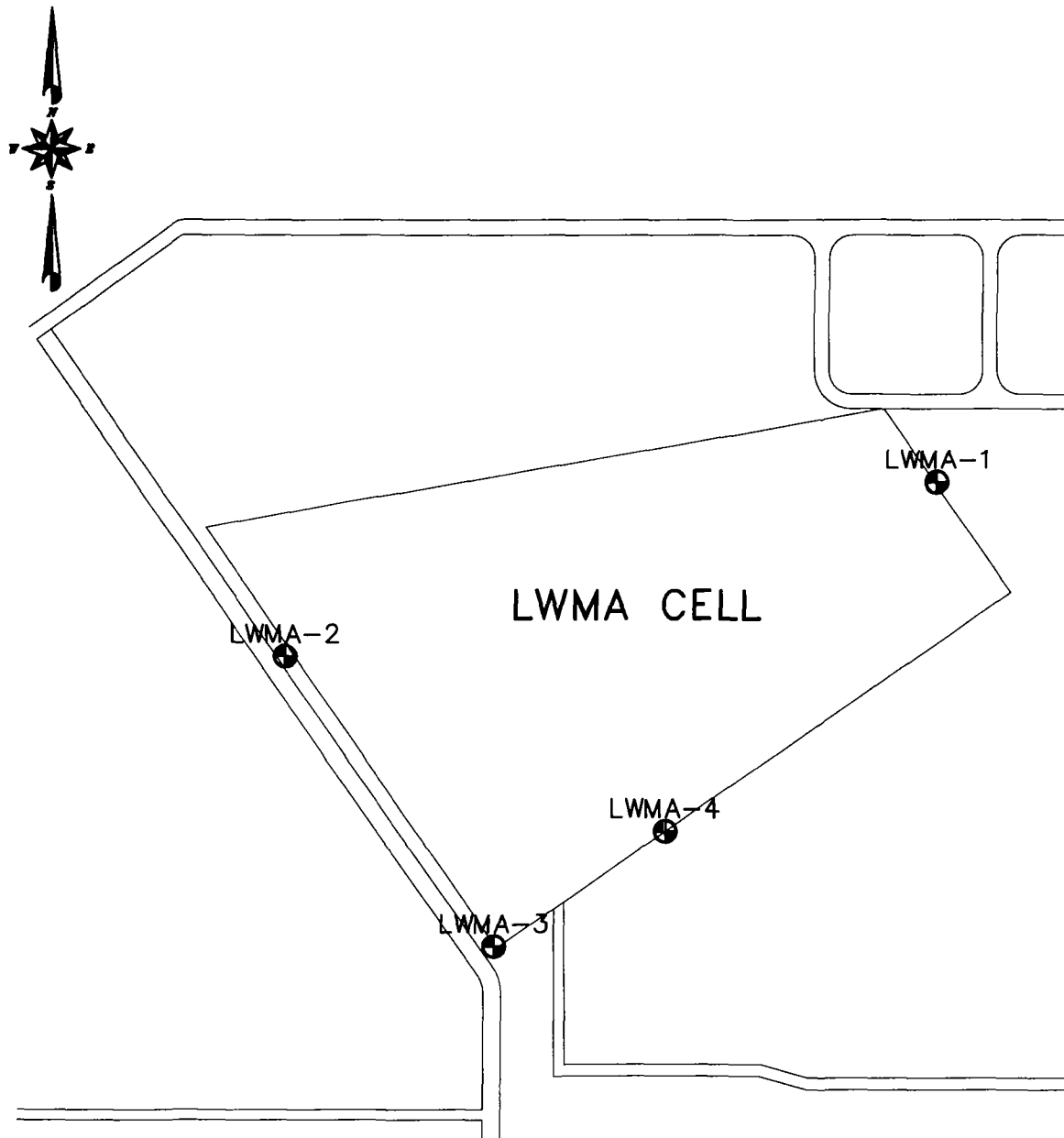
LOCATION OF RWMA COMPLIANCE WELLS

SCALE 1" = 300' DATE 08-14-03

C. C.

S. D.

FIGURE 1-2



REV



EarthFax



Chevron Products Company
Salt Lake Refinery

DR _____ CH. _____

DR APP. _____

ENGR. _____

OPR' G. DEPT. APPROVED _____

ENG' R. DEPT. _____

POST CLOSURE PERMIT

ATTACHMENT 1

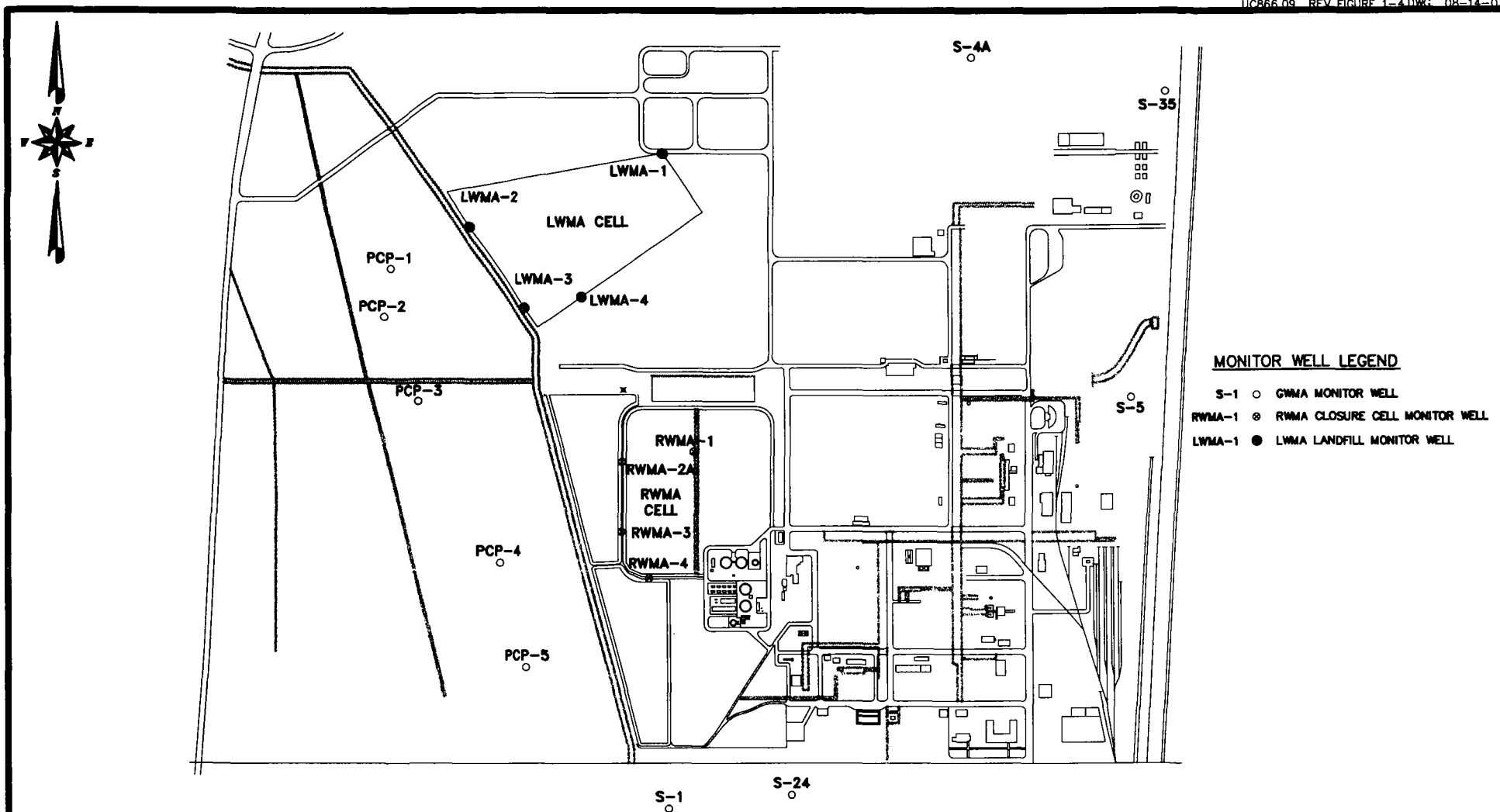
LOCATION OF LWMA COMPLIANCE WELLS

SCALE 1" = 300' DATE 08-14-03

C. C. _____

S. D. _____

FIGURE 1-3



Chevron Products Company
Salt Lake Refinery

POST CLOSURE PERMIT

ATTACHMENT 1

LOCATION OF ALL PERMIT COMPLIANCE

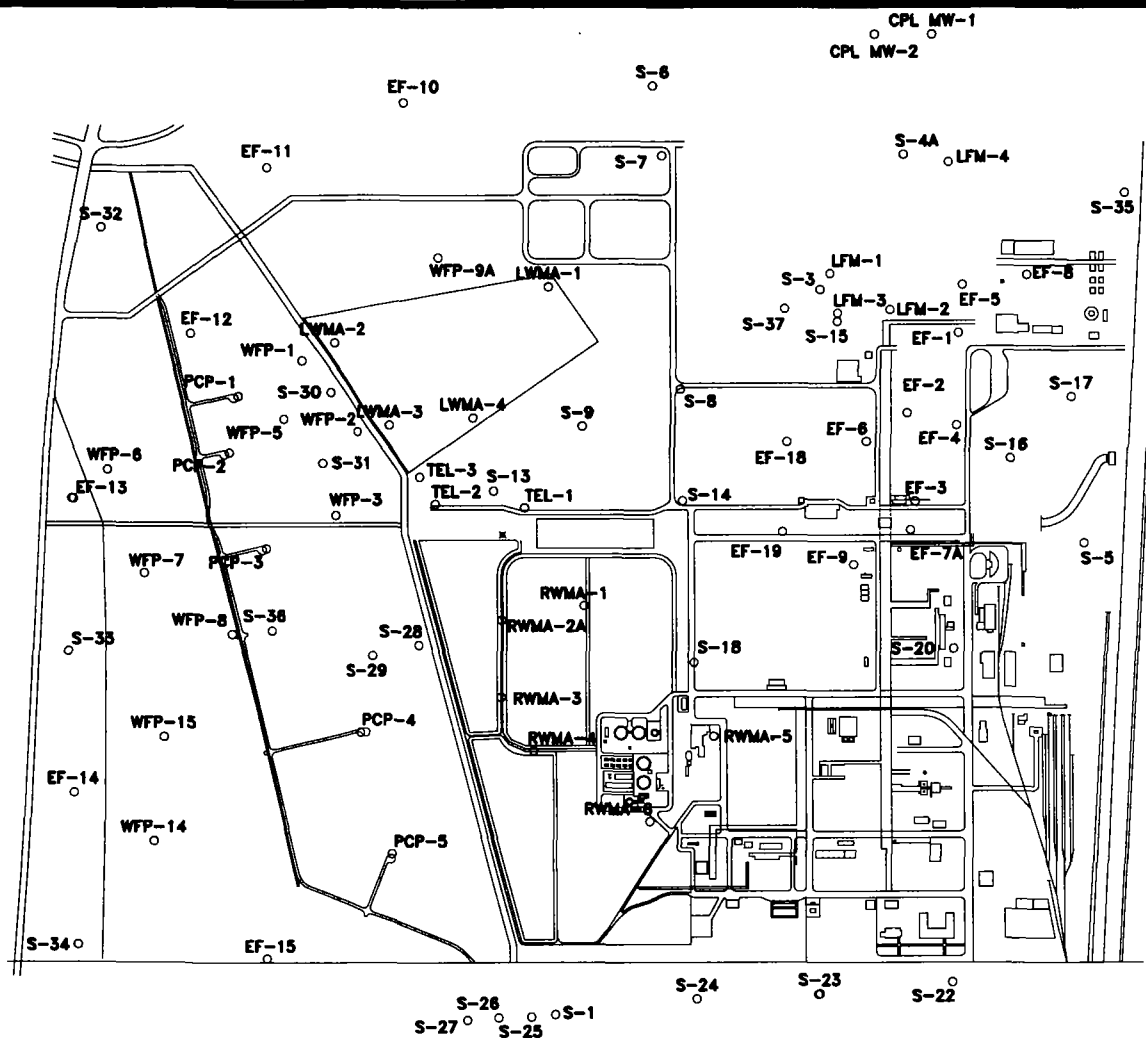
MONITOR WELLS

DR _____ CH. _____	OPR'G. DEPT. _____	APPROVED _____	SCALE 1" = 800'
DR APP. _____	ENG'R. DEPT. _____	DATE 08-14-03	C.C. _____
ENGR. _____			S.O. _____

REV



FIGURE 1-4



Chevron Products Company
Salt Lake Refinery

POST CLOSURE PERMIT

ATTACHMENT 1

LOCATION OF ALL FACILITY SHALLOW MONITOR WELLS

DR _____ CH. _____	OPR'G. DEPT.	APPROVED	SCALE 1" = 900'
DR APP. _____			DATE 08-14-03
ENGR. _____	ENG'R. DEPT.		C.C. _____
			S.O. _____



FIGURE 1-5

**CHEVRON PRODUCTS COMPANY
Salt Lake Refinery
Salt Lake City, Utah**

WATER SAMPLE ANALYSIS REQUEST FORM

Sampling Company:	Sampling Personnel:
Project Name:	Project Number:
Field Sample Number:	Laboratory Sample Number:
Date Sampled:	Time Sampled:
Analytical Laboratory:	Date of Shipment/Delivery:

Bottle Type	Number of Bottles	Preservative(s)	Analyses Requested

Special Requirements:

FIGURE 2-1 ANALYSIS REQUEST FORM

<p>CHEVRON PRODUCTS COMPANY Salt Lake Refinery</p> <p>Sample No.: _____</p> <p>Preservative: _____</p> <p>Date: _____ Time: _____</p> <p>Signature: _____</p>

FIGURE 2-2 SAMPLE LABEL

CHEVRON PRODUCTS COMPANY
Salt Lake Refinery
Salt Lake City, Utah

Page ____ of ____

CHAIN-OF-CUSTODY FORM

Sampling Company:	Sampling Personnel:
Project Name:	Project Number:
Analytical Laboratory:	Date of Shipment/Delivery:
Method of Shipment/Delivery:	Airbill Number:

Field Sample No.	Date Sampled	Time Sampled	Sample Type	No. of Containers	Remarks

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

FIGURE 2-3 CHAIN-OF-CUSTODY FORM

SAMPLE CUSTODY SEAL	
CHEVRON PRODUCTS COMPANY Salt Lake Refinery	Date _____
	Signature _____

FIGURE 2-4 CUSTODY SEAL

**CHEVRON PRODUCTS COMPANY
Salt Lake Refinery**

Page 1 of 2

SURFACE-WATER FIELD LOG

Station Number:	Location:	Date:
Sampling Company:		Sampling Personnel:
Description of Equipment Decontamination:		
Sample Type (Canal, Process Water, etc.):		
Sampling Methodology:		
General Observations:		

METER CALIBRATION DATA						
pH Meter					Specific Conductance Mtr	
Meter Used:					Meter Used:	
Item	pH 4 Calibration		pH 10 Calibration		Actual Sp. Cond. (μmhos/cm at 25°C):	
Time of Measurement						
Buffer Manufacturer						
Buffer Production Lot No.						
Buffer Expiration Date					Measured Sp. Cond. (μmhos/cm at 25°C):	
Measured pH						
Measured Temp. (°C)						
Calibration OK?	Yes:	No:	Yes:	No:	Yes:	No:

FIELD WATER-QUALITY MEASUREMENTS				
Time	pH (Units)	Temperature (°C)	Specific Cond. (μmhos/cm at 25°C)	Remarks

FIGURE 2-5 SURFACE-WATER FIELD LOG

**CHEVRON PRODUCTS COMPANY
Salt Lake Refinery**

Page 2 of 2

SURFACE-WATER FIELD LOG

Time Sample Collected:	Description of Sample (visual observations, number of bottles, etc.):
-----------------------------------	--

Additional Information (e.g., sketch of site, additional field measurements, notes on decontamination and sample handling, etc.):
--

Signature of Sampler:

FIGURE 2-5 (CONTINUED)

**CHEVRON PRODUCTS COMPANY
Salt Lake Refinery**

Page 1 of 2

GROUNDWATER FIELD LOG

Well Number:	Date:
Sampling Company:	Sampling Personnel:
Description of Equipment Decontamination:	
Sampling Methodology:	
General Observations:	

pH METER CALIBRATION DATA						
pH Meter Used:						
Item	pH 4 Calibration		pH 10 Calibration		pH 7 Accuracy Check	
Time of Measurement						
Buffer Manufacturer						
Buffer Production Lot No.						
Buffer Expiration Date						
Measured pH						
Measured Temp. (°C)						
Calibration OK?	Yes:	No:	Yes:	No:	Yes:	No:

SPECIFIC CONDUCTANCE METER ACCURACY CHECK			
Standard Manufacturer:			
Specific Conductance Meter Used:			
Actual Sp. Cond. (µmhos/cm @ 25°C):	Measured Sp. Cond. (µmhos/cm @ 25°C):		Accuracy OK?
			Yes: No:

INTERFACE/WATER-LEVEL MEASUREMENTS	
Meter Used:	
Depth to Top of Floater (ft)	
Depth to Top of Water (ft)	

FIGURE 2-6 GROUNDWATER FIELD LOG

CHEVRON PRODUCTS COMPANY
Salt Lake Refinery

Page 2 of 2

GROUNDWATER FIELD LOG

CASING VOLUME CALCULATIONS						
Depth of Well (ft)						
Method of Determining Well Depth						
Depth of Water in Casing ($D_{well} - D_{water}$) (ft)						
One Casing Volume (gal)						
Three Casing Volumes (gal)						
PURGE-CYCLE FIELD WATER-QUALITY MEASUREMENTS						
Time	Flow Rate (gpm)	Cum. Vol. Pumped (gal)	pH (Units)	Temp. (°C)	Sp. Cond. ($\mu\text{mhos/cm}$ at 25°C)	Remarks
Check here if additional measurements are recorded on the reverse side of this page:						
Time Sample Collected:		Description of Sample (visual observations, number of bottles, etc.):				
Additional Information (e.g., additional field measurements, notes on sample handling, etc.):						
Signature of Sampler:						

FIGURE 2-6 (CONTINUED)

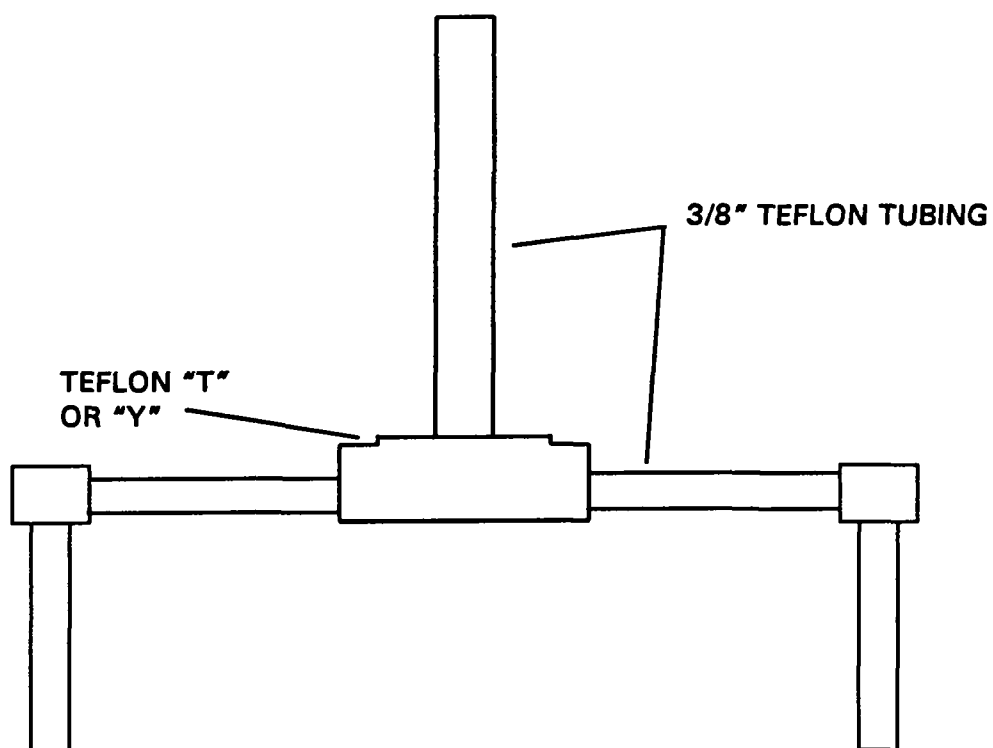
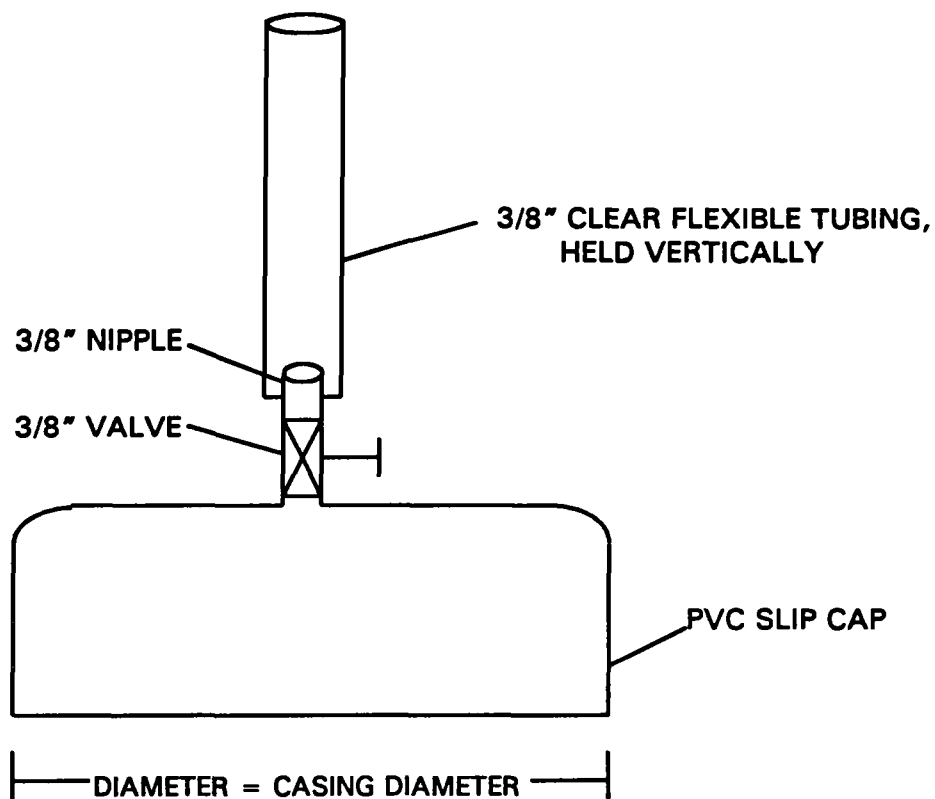


FIGURE 2-7 SAMPLE SPLITTER



NOTE: CAP TO BE SUPPLIED OVER CASING FOR
MEASUREMENT. SEAL ON OUTSIDE WITH
POLYETHYLENE TAPE IF NECESSARY

FIGURE 3-1 CAP FOR MEASURING WATER LEVELS IN FLOWING WELLS

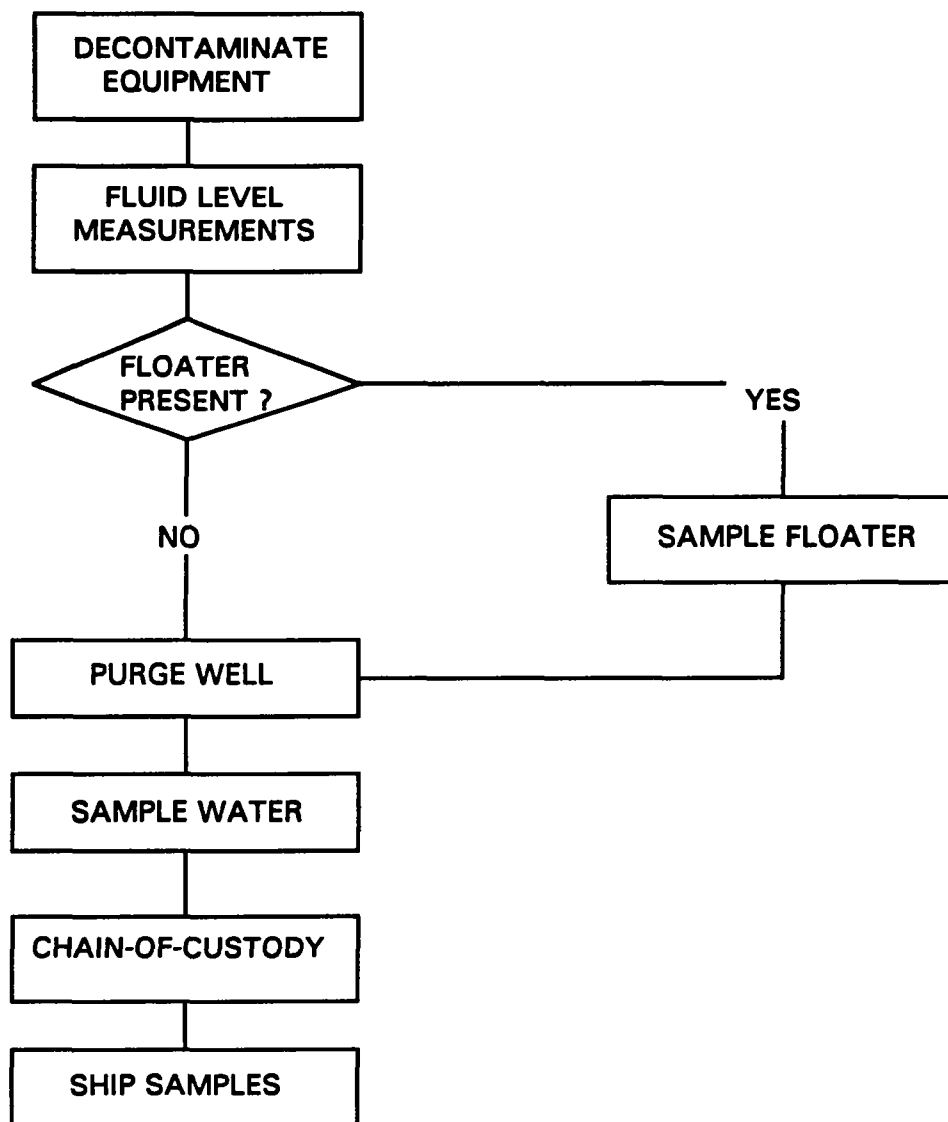


FIGURE 4-1 FLOW CHART OF GROUNDWATER SAMPLING PROCEDURES

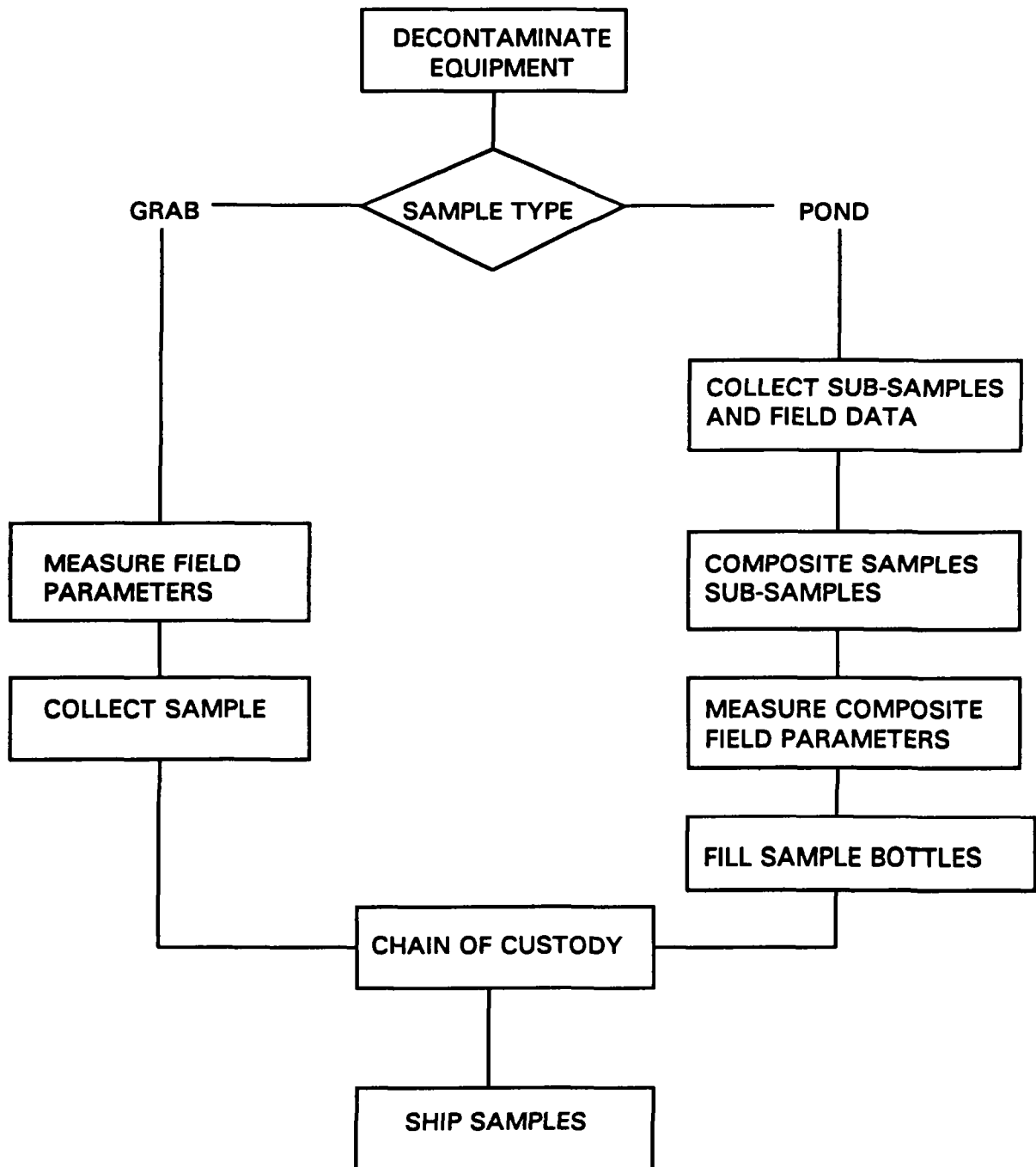


FIGURE 5-1 FLOW CHART OF SURFACE-WATER SAMPLING PROCEDURES